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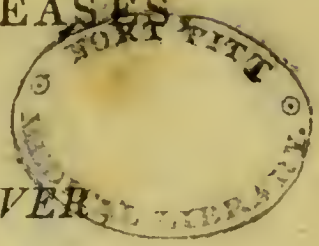
OBSERVATIONS

ON THE

BILE AND ITS DISEASES

AND ON THE

ŒCONOMY OF THE LIVER



READ AT THE

ROYAL COLLEGE OF PHYSICIANS,

AS THE

GULSTONIAN LECTURE

OF THE YEAR 1799.

BY

RICHARD POWELL, M.D.

FELLOW OF THE COLLEGE, &c.

London:

PRINTED FOR F. AND C. RIVINGTON,

NO. 62, ST. PAUL'S CHURCH-YARD;

BY BYE AND LAW, ST. JOHN'S-SQUARE, CLERKENWELL.

1800.

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AND
PHYSICIAN GENERAL TO THE ARMY;
THE FOLLOWING
LECTURES
ARE INSCRIBED,
AS A
TESTIMONY OF RESPECT
FOR HIS
PROFESSIONAL AND PUBLIC CHARACTER,
AND OF
GRATITUDE FOR FAVORS CONFERRED UPON
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IT is necessary to mention that the following pages were printed in April last, and that they have been detained thus long in daily expectation of receiving from the engraver two colored plates, whose references are given at the end. The drawings were delivered to Mr. Hinton for this purpose in January, under a verbal agreement that they would be ready in two months, but it was not till the end of December that one hundred of the finished copies were brought to the publisher. For these the charge is so enormous, and so much beyond the expectations founded on his statement to me, that I feel it a duty not to impose it upon the public, but to stop any farther impression for the present. It is probable that our settlement will not be very speedily made; when it takes place the plates shall be added to an Appendix, and their price shall not exceed what is paid for them to the engraver.

R. P.

Effex-street,
January 6, 1801.



OBSERVATIONS

ON THE

BILE, &c.



EVERY class of animated beings which has been examined, even those insects whose minuteness requires the assistance of a microscope to discriminate their several parts, possesses a liver, or something which has struck anatomists as analogous to it. Its bulk in the human subject, and the various diseases to which it is liable, give a still greater degree of interest to the consideration of a part of such universality and importance. It is my intention to treat of its physiology and some parts of its pathology, using the liberty of enlarging upon those particular points in each of these, which I conceive capable

of farther elucidation, and if I shall appear to differ from opinions which have been sanctioned by time and authority, I trust the dissent, even if it be thought unfounded, will not be considered as frivolous, or as arising merely from a love of novelty and change, but rather as dictated by an honest zeal for the enlargement of our professional means of alleviating the calamities of human nature.

THE glandular mass called the liver is, in the human adult, the largest in size of all the abdominal viscera. The irregularities of its shape scarcely allow of comparison with any definite figure, it may perhaps, in its general outline, be thought to bear a nearer resemblance to a cone, divided longitudinally, than any other, the base of which occupies the whole of the right hypochondriac region, and it gradually diminishes in bulk as it stretches across the epigastric, till it reaches its apex in the left hypochondrium. It is by the irregularities of its form, accommodated, and as it

were moulded, to the parts with which it lies in contact. Its superior surface has a regular and unbroken convexity of shape, and is closely applied, through the whole of its extent, to the arch of the diaphragm, with which it is connected by three duplicatures of the peritonæum, called ligaments; the central and chief of these runs entirely across its surface, and contains, in its anterior part, the ligamentous remains of the vessels which carried on the foetal circulation; the course of the ligament divides this surface unequally into what are called the right, or greater, and the left, or lesser, lobes. The inferior surface has also a similar division, formed by the insertion of the foetal vessels, which are continued in a deeply indented groove, till they reach the vena cava ascendens; its outline is more irregular than that of the upper, and is varied by a number of unequal eminences and depressions. Some of these seem only intended to accommodate the neighbouring viscera;

thus, in the right division, there are two slight depressions, one of which answers to the situation of the transverse arch of the colon, and the other, to that of the superior part of the right kidney; and in the left division there is one superficial, but extensive, excavation for the reception of the surface of the stomach: in the same way the hinder edge gives a passage to the vena cava, and waves round the projecting column of the spine; and the anterior forms an acutely indented fissure, where the suspensory ligament passes beneath it. Other depressions are intended for the reception of parts necessary to its own œconomy; such is that excavation, formed by the horizontal fissure, and another, which intersects it at right angles, called the transverse, in the depth of which, enveloped by the cellular membrane, which forms the capsule of Glisson, lie the sinus of the vena portæ, and the trunks of the several vessels and nerves by which the liver is supplied, and its secreted fluid

carried away. To two of the eminences, formed by the projecting substance of the liver at this point of intersection of the fissures, has the name of *portæ* been given, and the outer of these, which projects farthest in a widening triangular shape, forms the lobe of Spigelius. Behind these *portæ*, in a deep groove, runs the *vena cava ascendens*, and before it quits the viscus, in its passage upwards to the tendinous part of the diaphragm, receives the blood from the trunks of the collected branches of the hepatic veins.

In the anterior part of the horizontal fissure, in a depression, which is hollowed out for the reception of one of its sides, lies the gall bladder, a pear shaped, oblong, muscular, highly vascular, and glandular bag, usually of about the size of a hen's egg. Its obtuse end projects somewhat forward, beyond the edge of the liver itself, the point from which its duct arises being directed backwards, with a double curve, to the general receptacle of the hepatic vessels.

The muscularity of this bladder has been questioned, upon the ground that no fibres resembling muscle are demonstrable on dissection. All its ordinary functions might, perhaps, be supposed to be carried on from extraneous causes, such as the motion of the liver upon the other intestines during the alternate contraction and dilation of the diaphragm and abdominal muscles, and the variable degree of tension from repletion, of which the neighbouring viscera are susceptible; but, in some cases, these extraneous powers do not produce its evacuation, though they subsist in their full force; and, in others, where irritating causes, such as concretions, have been present, it has been found contracted on either side them, and forming a permanent stricture; it does, therefore, appear to possess that contractility which implies the existence of muscular fibre as its cause.

Supposing then the existence of a muscular coat, the gall bladder possesses two others, one which is external to it,

and membranous ; and another, which is internal, and which, from its general appearance, would lead us to imagine that it performs some more important office than that of a reservoir only. It is highly vascular and rugous, with folds, which project inwards, so as to build up a reticulated surface, and thus bears a close resemblance to the structure of the interior coat of the stomach, which we know certainly to be a copiously secreting organ.

Many authors* have also demonstrated the existence of numerous small glands, situated in the cellular membrane, immediately under the internal coat, and abounding most near to the neck of the bladder : that these are not always to be discovered is no objection to their existence, and it is probable, that where they have been readily found, there has been some enlargement of their size from disease.

* Ruysch, Ep. 5. Bianchi Hist. Hepat. Vol. II. p. 978.
Vicq. d'Azyr, Mem. Par. Vol. II. p. 255.

The liver, in common with other glandular parts, is furnished with an abundant supply of arteries, veins, nerves, and absorbents; it has also the vena portæ and biliary ducts, which are peculiar to itself.

The artery from which its chief supply is drawn is called hepatic; its most common origin is from the cæliac, but it has occasionally been found to arise directly from the aorta, between the cæliac and mesenteric. After having given off small branches to those parts which lie in the neighbourhood of its course, it enters the capsule of Glisson, with the vena portæ, and then, dividing into two large branches, ramifies with it through the whole structure of the liver. Besides the great trunk, there are also smaller branches sent to this viscus from the larger coronary artery of the stomach, from the trunk of the mesenteric, and others, of still less size, from the mammary, phrenic, capsular and renal. From the hepatic artery

arises a branch which supplies the gall bladder.

The hepatic veins, collecting themselves from all parts of the substance, are, at last, inserted by a varying number of trunks, of which two or three considerably exceed the rest in size, into the vena cava, where it passes behind the posterior margin of the liver. The veins of the gall bladder discharge their contents into the vena portæ.

The nerves accompany the hepatic artery through all its ramifications; they are principally derived from the plexus solaris, which is itself formed of fibres, which come from the inferior part of the semilunar ganglion; they arrange themselves around the artery, forming a kind of net work, and constitute the hepatic plexus; from hence fibres arise, some of which attend the vessels through the whole substance of the liver, whilst others run to the gall bladder, and also with those branches of the hepatic artery, which go to the great curvature of the stomach, and other neighbouring parts.

The absorbent vessels of the liver have been traced with great minuteness, and in much greater abundance than those of any other viscus, on account of the numerous communications between their several branches, and the relative facility with which injections pass into them, for it not unfrequently happens that, in this particular organ, they will run from the trunks of these vessels into their branches. They have been divided into the superficial and deep seated; of the former, some bend their course towards the suspensory ligament, and others to the right and left ligaments, where their trunks pass through the diaphragm, at either point, and all ultimately reach certain glands, situated on the anterior part of the pericardium, and these send off one large trunk, which commonly joins the thoracic duct, near to its termination. On the under surface they are most evident near the fundus of the gall bladder, and all of them run irregularly towards the glands, which surround the trunk of

the vena portæ; and lastly, communicate with the thoracic duct, by directing their course towards it, behind the pancreas. The absorbents of the interior accompany the branches of the other vessels, and also run to the glands, which are situated round the vena portæ, and from thence to the thoracic duct, which they reach near the origin of the superior mesenteric artery. The whole series, whether superficial or internal, appear to be connected together by numerous anastomoses.

Next with respect to the vessels peculiar to the liver.

The vena portæ collects all the blood, which has passed through the arteries of the abdominal viscera, into one trunk, which is formed immediately by the junction of the splenic mesenteric and gastric veins; it enters the transverse fissure of the liver between the projecting portæ, from which it is named, when it divides into two large branches, which run at right angles to each other; these subdivide again, and ramify, in

a decreasing series, through the whole substance, like arteries, affording the only instance in the body in which a vein divides into branches, after having once united to form a trunk in its course towards the heart. Like the veins of the other viscera, the vena portæ has no valves; this, therefore, does not constitute any peculiarity in its structure, or bring it nearer to the state of an artery than those of the brain, or lungs, or kidneys. It seems more loosely attached to the substance of the viscus than the hepatic veins, and, therefore, collapses more when cut through; partly by this circumstance, but more especially by the different direction in which its branches run, it is distinguishable from the hepatic veins.

The biliary ducts answer as excretories to the liver, collecting the fluid, secreted by the extremities of the other vessels, from each branch of which a correspondent biliary canal uniformly arises. These unite gradually to each other, till they emerge from the substance of the

liver, into the large fissure, in two or three trunks, which immediately unite into one, and the duct thus formed, runs, included in one common capsule, with the hepatic artery and vena portæ, and keeps a straight course towards the duodenum, under the name of hepatic duct. After some progress the duct of the gall bladder is inserted into it at an obtuse angle, after which, it passes on till it has reached the duodenum, between the coats of which it runs obliquely, for a short distance, before it opens into the cavity of that intestine, which it does at some distance from the pylorus, where the gut forms a curve before the right kidney. Previous to its opening, the mouth of the duct has most commonly united with that of the pancreas, but sometimes they are separate, though closely in contact with each other. At the point of their entrance they project within the gut, so as to form a distinct tuberculated point, which is very sensible to the touch.

The structure of the hepatic and common duct appears to be entirely membranous, with a number of visible perforations, which probably secrete a mucous matter, for its own defence, from the contact of the fluid it conveys; whilst that of the cystic duct is reticulated by projecting folds, through the whole of its length, like the internal coat of the bladder itself. As then this difference between the hepatic and common, and the cystic duct, subsists, the latter ought rather to be considered as a part of that bladder, participating in all its functions, and contributing to whatever change is there produced upon the bile, than as a simple canal of communication between it and the general duct.

Of these vessels, connected together by cellular substance, is the mass of the liver built up, the connection seems, at their extremities, to be more intimate, and less easily destroyed, than in any other part of their course, giving, at those extremities, the appearance of

small lobes, or acini, as they have been called. This opinion of the more minute structure of the liver, has also been strengthened by the general form it bears in animals, which require much motion of the spine, for the purposes of their œconomy, as in the cat kind, where the liver is evidently composed of a number of distinct lobes. Observations, however, upon the minutiae of anatomy, even when aided by the powers of the microscope, are so fallacious, as rarely to deserve more than the name of speculations ; it is probable that, in the extreme branches of all secreting vessels, there is some peculiarity of structure, by which they are enabled to produce such striking changes in the circulating blood ; but these powers seem rather to depend upon, and be connected with, the exercise of the principle of life, than any mechanical difference in their form of vessels.

With respect to the relation which these several sets of vessels bear to each other, injections seem to prove the ex-

istence of a general and mutual communication between them, so that if water be forced into the trunk of any one, it will return by the trunks of the others. What is the nature of these communications we know not, or whether they exist at all thus generally in the living body : it is certain, if they do, that their series of actions is well established, and it does not appear to be even in the power of disease to invert any of them.

The liver, like the other abdominal viscera, lies externally to the peritoneal bag, and protruding into it, receives over by much its greatest part, a general covering of that membrane, accommodated by its flexure to the general shape of the viscus and its appendages, and closely attached to them. The peritonæum too, as it is reflected from the diaphragm and parietes of the abdomen in order to reach the liver, forms, by its duplicatures, the several ligaments by which the mass is suspended.

The size of the liver in adults admits of considerable difference, without any alteration of its structure from disease; at a medium its ordinary weight may be estimated at about three pounds, or somewhat more: but the variations of its weight and relative bulk are, in many cases of disease, most striking; I have seen a liver weighing little short of forty pounds. This increase may be connected either with a more firm and dense, or with a more lax and spongy state of its substance, so that the weight does not always bear the same relation to the size. Sometimes its natural bulk is diminished, though this alteration is uncommon, and is always attended with increase of hardness.

As the liver is intimately attached to the diaphragm, so it is, in some degree, influenced by its alternate contractions and dilatations, and, on this account, its relative situation to the external parts of the body admits of some variation; ordinarily, however, its anterior edge

has that of the ribs for its boundary, and does not descend lower. As it rests also upon the stomach and colon, its situation is somewhat affected by the state of their cavities; if, from any cause, they be much distended, the liver is elevated, the free descent of the diaphragm is impeded, and the breathing becomes difficult in proportion; where, on the contrary, the intestinal canal is empty, a part of its wonted support is withdrawn, and the diaphragm is, as it were, dragged downwards, by its dependence on the suspensory ligaments attached to it.

The situation of the liver appears also to be susceptible of alteration from other positions of the body, and to be considerably regulated by the gravitation of so large a mass. In an upright position it descends lowest; when lying on the back, the curve of the spine forms an inclined plane, and it slides along it, receding from the edge of the ribs, and pressing against the diaphragm. This unfavourable posture is generally

chosen for external manual examination of the liver, nor is it alone unfavourable by removing the object of search farther from our reach, but it is also connected with a tension of the abdominal muscles, affording, by their resistance, another impediment to the examination of the subjacent parts. It has always appeared to me much better to have the patient standing, with a little flexion of the body forwards, and by giving him a support to prevent the posture from being occasioned by contraction of the abdominal muscles. This assists the gravitation of the liver towards the point where the hand is to be applied, and, under these circumstances, the edge can mostly be felt, and a tolerable judgment formed respecting it, unless the thickness of the integuments be much increased by fat; but in every case I have always fancied that any general affection is best discovered in the epigastric region, where the tendinous expansion of the diaphragm affords more resistance from behind, and

where, as it crosses that region, it is not covered by the ribs.

In the foetus the liver is the first formed of all the abdominal viscera, and has attained considerable size before the stomach, intestines, kidneys, or even the lungs are visible*. It also differs more in its structure, form, and size, from that of the adult than any other viscus of the body. It is proportionably much larger, and chiefly in its left lobe, for it stretches so far into the left hypochondrium, that the suspensory ligament makes nearly an equal division of its substance, and it occupies the greater part of the whole cavity of the abdomen. In its healthy state it has also a darker colour. Independent of its supply of blood from the vessels which have been mentioned, it receives a large quantity from another source, through the umbilical vein, and is the medium through which most of the blood passes which flows from the pla-

* Haller Formation du Poulet, p. 123.

centa to the foetus. In this distribution does one great peculiarity of the foetal circulation consist. The umbilical vein arises from the collected branches of the placenta, and enters the foetus at the navel, it runs inclosed within a thick sheath, which afterwards forms the lower part of the suspensory ligament, to the horizontal fissure, where it gives off some branches on either side to the substance of the liver; of these the most numerous and largest run to the left, they ramify chiefly in the inferior part, and at last unite to the extremities of the hepatic veins. When the great trunk has reached the hollow, formed by the conflux of the two fissures, it gives off two considerable branches, and then terminates somewhat abruptly, in a rounded projecting point. One of these, named ductus venosus, runs along the horizontal fissure, and, dilating considerably, unites with the left trunk of the hepatic vein, into one large canal, which enters the vena cava just below the diaphragm. The

other, soon after its origin, joins the vena portæ, forming a large, but short, canal, and, in common with the blood collected by that vein from the abdominal viscera, the placental blood is distributed through the liver, and, after being again collected by the hepatic veins, is discharged into the vena cava.

When the connection between the child and its mother is broken, and it has become an independent being, the necessity for the peculiar vessels, which have ministered to that connection, no longer subsists, even the trunk of the umbilical vein is gradually obliterated as well as its dependencies. I do not however mean to state the perfect obliteration of that trunk as even a common occurrence, for, in most instances, it will, in the adult, admit of the passage of a probe: but it is impervious to the circulating blood, and ordinarily contains none of it, though the time at which it becomes so is by no means constant. In most cases it begins to close soon after the birth of the infant,

and to assume the appearance, as well as office, of a ligament; but it has occasionally happened that the umbilical vein has been found open, as far as the navel, and filled with blood from the vena portæ, in subjects of very advanced ages. At about the age of five years, and not before, the liver has lost its foetal characters entirely, the whole occupies less relative space, the left lobe bears a diminished proportion to the right, and it has the usual appearances of this viscus in adults.

One of the grand purposes of the liver, in the animal œconomy, is the secretion of that fluid called bile.

Before, however, the properties of bile are considered, it is matter of great physiological importance to endeavour to ascertain from the extreme branches of which of the vessels, carrying blood to the liver, the hepatic artery, or the vena portæ, this particular fluid is secreted; and the more so, because it seems to me, that the common opinion

is not so well established as to make any objection to it presumptuous.

The highest authorities, since the discovery of Harvey, which destroyed the ideas of the antients, respecting the importance of the liver to the motion of the blood, have given this office to the vena portæ, and the following are the chief arguments upon which they have rested this opinion. That no other idea can sufficiently explain the peculiar distribution of the vena portæ through the liver, differing as it does, in the ramifications of its trunk towards the heart, from every other vein in the body. That the distribution of its extreme branches, when they are injected, resembles the distribution of those arteries which are known to be secretory. That no other reason can be given why a branch of vena portæ should so constantly, and uniformly, accompany a branch of the biliary duct. That the venal blood, as it returns from the intestines, the veins of which unite to form the vena portæ, is necessarily

loaded with acrid and oily particles, and, therefore, is more particularly suited to the secretion of, what was thought to be, the most acrid and oily fluid of the whole body. That there is not the usual relation of size between the branches of the hepatic artery and the biliary duct, and that if this artery formed the bile there would not have existed ducts, for the reception of the secreted fluid, of a larger capacity than the whole of the secreting artery, while the branches of vena portæ are larger than those of the biliary duct, and thus stand to them in the usual relation; and, lastly, that Malpighi performed the experimentum crucis by tying up the hepatic artery of a living animal, and finding that the secretion of bile was not interrupted*.

* In brutis ligata arteria hepatica prope truncum cœliacæ, laceratoque bilis folliculo vel etiam avulsis ejusdem tunicis coercitoque pancreatis vase, superstiti per diem animalis vita, per portam in jecur irruente sanguine, bilis ingens copia e poro biliario & choledochæ in duodenum transducta colligitur, quæ colore nequaquam consimili pollet cum dilutior sit, nec tantum lentoris & amaritiei obtinet

The whole of these arguments, except the last, are to be considered as inferences from analogy rather than from actual experiment; and that of Malpighi appears, on consideration, very unsatisfactory and indecisive, for though he did cut off the source of its arterial blood from the liver, he could not exhaust the vessels, ramifying through its substance, which were previously filled with it, nor could he clear away the bile already formed in the viscus, or ascertain what portion of that he afterwards found was secreted before the performance of his operation, unless his animal had lived a much longer time than a single day after it: I think, moreover, that the other statements, respecting the peculiar distribution, will admit of another, and that a probable, explanation, and that, as far as relative size goes, it is by no means impossible

quantum passim bilis vesicæ possidet, & si igne vel alio consimili exagitetur vehementissimum exhalat odorem aliaque longe diversa a cysticæ bilis natura patitur. Malpighi de Lienc. p. 120.

for the hepatic artery to answer the purpose of biliary secretion. From the general influence of some prevalent theory upon medical opinions, and the plausibility with which that of the Boerhaavian school reduced the actions of the animal œconomy to the reach of vulgar comprehension; I believe the weakest of these proofs has had the greatest effect in the establishment of the received opinion, namely, that the nature of the blood returning from the intestines must be especially suited to the formation of bile. It should be proved, previous to such an assertion, that the vena portæ carries a different blood from veins in general, and particularly from that of the vena cava, after it has received the hepatic veins; now this has not been attempted: if indeed such a difference could be established, it would throw considerable light upon the œconomy of the liver, but at present it must be admitted that all the facts applicable to the blood of the one are applicable also to that of the

other. This point has been investigated by others*, and I too have tried the small quantities I could obtain from dead bodies, without being able to make out the slightest shade of difference.

On the other hand, the analogies seem still more strong, which would lead us to suppose, that one case of secretion resembles every other, and that it is performed by an artery in the liver, as it is known to be in the other glands of the body, and the close resemblance it bears, in some respects, to the avowed arterial secretion of the ear, would somewhat strengthen the opinion. But still farther than this there is a case on record, which seems more decisive on this subject than any artificial state which can be induced by experiment. I allude to the dissection related in the Philosophical Transactions †, by the learned and accurate Mr. Abernethy, where the vena portæ was

* Hunter on the Blood, p. 76.

† Vol. lxxxiii.—1793.

entirely wanting, yet good and perfect bile was found in the gall bladder. In this instance then the artery did secrete bile, it secreted it too without any assistance from the vena portæ, and it has been explained by supposing, that in a deficiency of one part another can occasionally take up its necessary functions; this is surely not going so far as the data will justify, or even reasoning fairly, we might just as well suppose it possible if the liver was entirely wanting, for the pancreas, or any other viscus, to secrete the bile.

It may likewise be mentioned, that the peculiar distribution of blood by the vena portæ subsists at a very early period of the existence of the foetus, though it is chiefly supplied from another source, and that this cannot be intended for the secretion of bile, which takes place in so small a proportion to its cause during the continuance of the foetus in the uterus.

To my mind, therefore, it seems as

if the secrétion of bile was the particular function of the hepatic artery.

To assign another cause for the remarkable distribution of the vena portæ through the liver, is a subject of difficulty and hazard. I am, however, strongly led to avow, in part, the same idea that the antients entertained, and to consider it as subservient to the purposes of the circulation, as a sort of reservoir to the heart, which prevents the rapid return of blood to the right auricle, which would take place without it; and, under circumstances of difficulty or obstruction to its passage through the lungs, allowing, by its distension, of a considerable accumulation for their relief.

I have been chiefly led to this opinion by an attention to the circumstances of some diseases; my own experience, however, has been hitherto too limited to give it the stability it requires, but still there are some circumstances which are too striking, and

have occurred too often, to be the effect of chance alone.

Authors have established a certain connection in their symptoms between many diseases of the liver and of the lungs, some of which have so much in common as to render discrimination difficult; but it has generally been thought, in such cases, that the liver was the original seat of complaint. I know but of one passage where the contrary has been suspected, and this is given by Dr. Andree*, who quotes the opinion of a Mr. Pasley, a practitioner in India, that in all confirmed diseases of the lungs the liver is affected.

In examining phthifical patients, or such as have, from any cause, had the lungs rendered less pervious to the circulating blood, I have very frequently found the liver enlarged in its size and looser in its texture, in some very considerably so, and appearing little more

* Considerations on Bilious Diseases, &c. p. 21.

than a connected mass of blood, readily giving way, and breaking down on the application of slight pressure; and, in other cases, injections pushed into the vena portæ have seemed to distend the liver more readily and completely than where no disease of the lungs subsisted. The more violent of these affections of the lungs are also attended very commonly with great fullness of the abdomen and tension, especially about the region of the liver. I have a case in my recollection where the formation of matter to a vast extent had taken place in the right lung, and had entirely destroyed it, in which the affection of the abdomen was so striking *

* A case given by Hallé may be considered as affording a strong analogy. In a vast schirrus of the right lobe of the lungs, pressing upon the heart and its vessels, and obstructing the circulation, all the abdominal viscera were distended with blood. He proceeds, *Le Foi me parut beaucoup plus volumineux qu'à l'ordinaire & d'une couleur presque noire mais sitôt que j'en eut ouvert la substance, il en sortit des flots de sang, & ainsi degorgé, il se rapprocha beaucoup de son volume naturel, & ne parut, en aucun endroit, avoir subi aucune alteration, avoir souffert aucun engorgement.*

Memoires de Medecine, Vol. I. p. 117.

as to induce the medical attendants, who were high in fame and ability, to rub thereon large quantities of mercurial ointment. It is known too, that, in cases of accumulation of liquid within the lungs, the liver descends considerably below the edge of the ribs; if this was so immense in quantity as to fill the whole right cavity, and distend the diaphragm permanently, the liver which is attached to it must necessarily be pushed downwards, but it happens that all such collections of fluid do affect, by their pressure, and diminish the capacity of the lung, rather than counteract the whole force of the abdominal muscles, which are employed in expiration for the elevation of the diaphragm, and consequent diminution of the capacity of the thorax; but still it is true that the liver does descend, and I think such descent may generally

It is remarkable that Hallé, in the case above mentioned, suspected the liver to be the seat of the disease. *J'imaginois que le foie descendu jusqu'à l'ombilic & fort dur a toucher étoit le siège principal du mal.*

be accounted for by its increase of size. I have avoided mentioning this enlargement as consequent upon diseases of the heart, because it is not so upon all or even most of them; I have twice seen it combined with dropfy of the pericardium, and once with great flaccidity and enlargement of the whole heart, but never with ossification of the valves, or some other of its diseases which would seem to affect the circulation. It is known, moreover, that when any obstruction subsists to the passage of the blood through the lungs, the foramen ovale is often found open; this, therefore, seems to be one mode which nature employs to relieve the load upon the lungs and right ventricle, and it is probable that such cases would not be attended with that affection of the liver I have described; I know not whether the two appearances are ever combined, but in the two last of these enlarged livers, which I saw, the foramen ovale was not open. I have thought, too, that where diseases of the lungs seem

to have produced enlargement of the liver in the first instance, that after they have long continued, the parts seem to accommodate themselves to the new circumstances in which they are placed, and to recover, in some degree, their original proportions. If we also reflect upon the existence of this same distribution in the foetus, where it does evidently serve the purposes of the circulation, we shall, perhaps, be more induced to believe that its functions in the adult are still the same and unaltered.

The liver under this point of view will rise in its importance in the animal œconomy; it is not to be considered as a mere glandular mass, suited to the secretion of a particular fluid, but as ministering to, and, in a certain degree, regulating the circulation of the blood. Perhaps these opinions do not, from their nature, admit of perfect demonstrative proof; it will be enough if, in the present instance, they carry with them probability, and lead to the

farther investigation of those physiologists whose reflections bring them to the same conclusion with Haller.—

Non possum non suspicari, præter Bilis secretionem esse hepatis peculiarem utilitatem.

BILE is a fluid of considerable spiffitude and tenacity, of an intense and peculiar bitter taste, and rather a nauseous smell. Its color is various, either of a bright golden yellow, or dark brown, or deep green, or of some intermediate tinge. Its specific gravity is uniformly greater than that of water; I have found it 1,01, and 1,05.

It can only be collected in any quantity from the gall bladder, and when accumulated there it is found to differ in some respects from the bile as secreted by the liver. I believe that this difference does not extend to its taste or color. The latter appears deeper from the greater quantity and density of the liquid, but if this and hepatic bile be equally and lightly smeared upon paper their tint will be very nearly the same.

The cystic bile is of much greater spissitude than the hepatic, and this difference depends upon some change produced after its reception into the gall bladder. This is commonly attributed to the removal of its aqueous parts by the action of the absorbents, but I think it probable that it depends upon other circumstances.

The bile is a perfect solution in water of a particular compound matter, and no mechanical means can separate them; if the absorbents effect this, they must possess a discriminating and discretionary power of separating the solvent from the solvend, with which they do not seem to be endowed, and without which all the alterations they are supposed to produce upon this and other fluids are explicable; besides, where, as in jaundice, these vessels are certainly known to act upon the bile, they do not make this distinction; its aqueous part alone is not then removed, it is not inspissated, but it is absorbed *in toto*.

The gall bladder has internally a structure which, from analogy, appears peculiarly suited to secretion; and when long continued obstruction of the cystic duct has prevented the passage of bile, or any other matter into it, it has been found filled with a colorless and gelatinous fluid, which must have been supplied by itself. This fluid coagulates on the addition of alcohol, and resembles that which the same substance forms when added to healthy bile; it is, therefore, probable that the gall bladder performs this office constantly, and that the presence of this matter in bile depends upon a secretion made from its internal coat. Upon this addition, too, does the increased spissitude of cystic bile seem to depend; it is sufficient for the production of the effect, but to ascertain the fact it was necessary to examine the comparative relations to alcohol of cystic and hepatic bile, and to notice whether the presence of this matter was demonstrable in the latter as well as the former. Hepatic Bile can-

not be well obtained in a pure and unmixed state, and, therefore, it is difficult to ascertain this point accurately ; to me it appeared that a certain degree of the same effect was produced in each, but that in the cystic it was infinitely the greatest.

Bile is wholly soluble in water into a transparent liquor diminishing in color in proportion to the degree of its dilution.

Heat separates the water it originally contained, and if collected it resembles pure water, with a faint impregnation from some odorous matter.

As the water evaporates, the remaining parts thicken into a brown tough extractive residue ; if the heat be greater than is necessary for this evaporation, and be longer continued, it dries more perfectly into a friable pitchy mass, which then seems to be very considerably changed in its nature.

The tough extract, if exposed to the air, softens and attracts moisture from it, readily dissolves in water, and ap-

pears to have undergone no change but what arose from its abstraction.

Alkohol separates from bile a great abundance of white membranous floculi, dissolving at the same time all the coloring particles, and assuming a tint of color proportionate to their quantity and shade.

The precipitate is separable from the colored liquor by filtration ; it generally retains some of the coloring particles so intimately united to it at the time of its assumption of a solid form, that it requires a very large proportion of alkohol to abstract it entirely ; this, however, may be done, and then it resembles the coagulum produced in serum of the blood by the same addition.

Heat coagulates ferous matter, even if it be mixed with four-fifths of water ; sometimes, but not commonly, it produces the same effect on bile, yet there is always a larger proportion of serum in the bile than is necessary for this purpose. It seems, therefore, that the presence of something prevents the ef-

fect of heat upon the serum, but admits of that of alkohol. Extract of bile, prepared from the tincture, was dissolved in a mixture of one part serum and four water, and the mixture was heated sufficiently for the coagulation of a similar one, to which no bile had been added; in this case no coagulation followed; it was prevented by the presence of the matter of bile, but this power was limited, for with a larger proportion of serum the usual effect followed.

The relative proportion of this coagulable matter admits of considerable variation, and it is indicated by the spissitude of the bile, and by the effect of alkohol; sometimes it is as thin as water, and alkohol produces but a slight change; at others it is almost as tenacious as bird lime, and the affection by alkohol is proportionally large.

The alkohol distilled from the tincture passes colorless, but has acquired a slight impregnation of a faintly odorous matter.

After this distillation there remains a dark colored residue of an intensely bitter, and joined with it a sweet taste; it is perfectly soluble, both in water and in alcohol, in all proportions.

By this latter process the part of bile, on which its peculiar characters depend, is separated from its serous and gelatinous part.

If a solution of the spirituous extract of bile be dropped into very dilute muriatic acid no effervescence takes place, but an abundant cloudy precipitate immediately forms, which is deep in its color, according to the quantity of matter precipitated; when this is very small it is a dirty white, when more abundant a deep brown.

Other acids produce a similar effect, but I speak more particularly of the muriatic, because it cannot be supposed to influence the result by its own decomposition.

The fact that bile is coagulable by acids and by alcohol is generally known, but the two effects have been com-

monly confounded together, and I know not that any one has shown how the agency of the one goes beyond that of the other, or examined the matter precipitable by acids, after that coagulable by alkohol has been separated.

The clear filtered liquor yielded, on evaporation, cubic crystals of muriat of soda; when acetic acid was employed acetate of soda was formed.

Thus it is proved that soda is present in the bile, and that it is not combined with carbonic acid, which would have produced effervescence, but with another matter which acids dislodge by their superior affinity.

It has been improperly adduced, in proof of the existence of an alkali in bile, that it assumes a green tinge when mixed with vegetable blue infusions; this change is probably deceptive, and at best very uncertain, for it may be occasioned as well by the bare mixture of the two colors, the yellow and the blue, as by the agency of an alkali.

From the employment of bile in the arts for the removal of greasy matters from cloth, and especially in preparing it, by such abstraction, for the reception of various coloring substances, it has been considered as a natural soap*, and inferred that it must be like soap composed of alkali and oil. From this fact, too, it has been supposed that its use in the animal body was explicable, and that it served to unite together the oily and aqueous parts of the food. The accuracy of the analogy between bile and soap might be questioned upon the ground that the same effect is often produced by the use of substances which contain neither alkali nor oil, as in the process of fulling by fullers earth, and the incorporation of oils and water, by trituration with mucilaginous matters. The opinion, however, has been more completely overthrown by experiment†. Human bile, under no

* Haller Primæ Linnæ.—Boerhaave Elem. Chem.

† Maclurg on the Bile.—Küchelbrucher de Saponibus.

circumstance whatever, if assisted by trituration or heat, can incorporate the least portion of oil with water, the oil speedily separating and rising to the surface. It was thought, by Schroeder, that the presence of saliva, or the analogous pancreatic juice, might influence the result, and he tried the experiment without any difference in the effect.

Painters use bile for mixing their colors, and thus rendering them fitter for working, and hence it has been deduced that it resolves and attenuates resinous and gummy substances, but it has been found not actually to possess any such property, for neither* ammoniac nor myrrh, nor balsam of Peru were dissolved by it in the least, and though some apparent union was produced during a long trituration of it with resin of jalap, there was an almost immediate separation when it ceased.

* Schroeder Experimenta ed veriore cysticæ bilis indolem explorandam capta. Gotting. 1764.

The precipitate from the solution of spirituous extract by muriatic acid, either collected by subsidence or filtration, had a deep dirty brown color, and somewhat of a fibrous appearance, and its taste was intensely bitter.

It was not inflammable, but fused upon the application of heat, and left a small cindery residue.

Water did not combine with it, it remained distinct, and sank to the bottom.

Alcohol immediately dissolved a great abundance of it, and assumed a bright brown color. The tincture, when dropped into water, formed an abundant precipitation. The evaporation of the tincture gave a residuary mass of a deep brown color, and intensely bitter taste.

Essential oil of turpentine did not unite with it.

Alkali (it mattered little whether potash or soda) immediately dissolved it, and formed a brown liquor, which appeared very accurately to resemble the

solution of bile, deprived only of its ferous part.

If a clear aqueous solution of the spirituous extract and lime water was mixed together, a turbidity immediately followed, and a brown flaky sort of matter collected at the bottom of the vessel.

Diluted muriatic acid abstracted the lime, and the insoluble peculiar principle of the bile remained separate.

It appears, therefore, that the attraction of lime for this matter is stronger than that of the alkali, which subsists in the original compound.

The natural compound of this bilious matter and alkali, being mixed with solutions of metallic salts, as those of silver, mercury, copper, or lead, interchanged principles by a double attractive force, and yielded precipitates. Acetate of lead, for example, gave a very copious one, which had a dirty brown tinge in the solution, soon subsided to the bottom, and dried into a deep brown mass, which, on being

heated to redness, swelled, liquefied, and at last left a cinder, in which small globules of the metal were visible.

The soda then of the bile is combined with another substance, the compound is soluble in water, and gives to this secretion its peculiar characters. This other substance has been considered as a resin, to which class of substances it has not sufficient affinity to justify the arrangement. It liquefies in a lower temperature, it can scarcely be called inflammable, it is insoluble in oil of turpentine, and unites abundantly and readily with alkalies. It seems rather to be a peculiar modification of animal matter, characterized by its bitter taste, and other appropriate relations, and to bear a strong analogy to a bitter matter, which exists, distinct from every other, in some vegetables, as the wood of the *quassia amara*. It may, perhaps, be denominated the animal bitter principle.

In investigating the physiology of glands, it has been considered as an

object of great importance to convert, by artificial means, the blood, from which all the secretions are formed, into a matter similar to that which the action of any particular gland produces. If, however, this change was actually effected, our knowledge of the agency of a secreting gland, which does not employ similar, or even analogous materials, would not be much increased, and this objection holds especially against those experiments which have been thought to explain the relation of bile to blood, by using nitric acid for the conversion of the latter into a yellow and bitter matter.

The relations of substances to each other are however always important, and I shall cursorily state what others have done, and the conclusions to which a repetition of these experiments has led me.

Fourcroy states that he mixed the fresh arterial blood of an ox with one third its weight of water, and exposed the mixture to a heat sufficient for its coagulation; that the liquor expressed

from the coagulum yielded, on evaporation, a liquor strikingly resembling the bile of the animal, in color, smell, taste, and chemical analysis*.

Every repetition of this experiment proves that there must have been some fallacy in it, and it has been suggested, as probable, that the blood of the animal had previously contained bile, which only became more apparent from concentration, and was not actually formed.

Mr. Higgins mixed two parts of fresh blood with one of colored *nitrous* acid, and one fifth of the whole of water; he digested the mixture in a heat of 212, till the acid was wholly expelled, adding occasionally more water to make up for what was lost by evaporation, till at last the remaining liquor had acquired nearly the color, and exactly the taste of bile. The *colored nitrous*

* Extrait d'une Memoire contenant une suite d'Experiences nouvelles faites sur les matieres animales au Laboratoire du Lycee a Paris par M. Fourcroy.—La Medicine eclairée, &c. Tom. II. p. 325.

acid he employed was distilled over in the form of *colorless nitric acid* *.

Mr. Archer, in repeating this experiment, obtained a liquor which resembled bile in its color only, for it had no bitterness of taste, and the whole of the acid was not detached till the evaporation had been continued, with repeated additions of water, for twelve hours †.

Dr. Bostock also dissolved each of the different constituent parts of blood in nitric acid, assisted by heat; he inferred, on comparing his results, that the red particles alone were suited to undergo a conversion into bile, and he supposed that this effect was produced by their oxydation at the expence of the acid. He neutralized the undecomposed part of the acid by a solution of carbonate of potash, and obtained nitre, mixed with a bright brown co-

* Comparative View of the phlogistic and antiphlogistic Theories, by W. Higgins, 1789.

† Miscellaneous Experiments on the Effects of Oxygen on the animal and vegetable Systems, by C. Archer. 1798.

loring matter; alkohol dissolved this, and left, on evaporation, a matter perfectly resembling bile *.

M. Welter, by the repeated distillation of nitric acid from silk, with another view, obtained octohedral crystals, of a yellow color, and remarkably bitter taste, which tinged the saliva yellow, were volatile in the fire, and were not decomposed even by nitric acid, but only robbed of their color, which returned again on the addition of water †.

There is considerable difference in the result of these experiments, as described by their authors. With me Mr. Higgins's process has not succeeded; the acid was not separated by a very long continued evaporation; and in proportion as it passed over, did the liquor lose its characteristic color. Dr. Bostock's succeeded better; it gave a deep yellowish brown mass, bitter in its taste, but, I think, more like the bitter

* *Thesis quædam de secretionibus in genere & præcipue de formatione Fellis complectens.*—Autore Joanne Bostock. Edin. 1798.

† *Annales de Chimie*, Vol. xxix. p. 301.

of aloes than of bile, which stained the fingers and cloth, which dissolved in alkohol, ether and water, and the latter solution frothed on agitation, which precipitated with acids and metallic solutions, and of which the most definite chemical difference from bile, seemed to be that its yellow color was brightened, and it was dissolved in lime water, with which bile itself produced a copious precipitation. I did not, however, find any difference in this respect between the several parts of the blood; all yielded to me a familiar matter, even perfectly limpid serum did so; and M. Welter's experiments also prove, that the presence of red particles is by no means necessary.

Upon the whole, these experiments are not at present either sufficiently various or established to justify conclusions respecting the relation of bile to blood, though they are of importance in themselves, and deserve to be the subject of patient and accurate investigation.

THE DISEASES which depend upon the state of the liver may be divided into such as affect the structure of the substance of the viscus, or its appendages; and such as consist in a morbid alteration of the fluid it secretes, either in quantity or quality, or in a derangement of its natural course. Like all other artificial divisions of the operations and productions of nature, this is certainly imperfect; but it affords a convenient arrangement for my present purpose. The consideration of each of these divisions would lead me into a field of vast extent, affording, at every step, objects deserving most minute investigation. I shall, therefore, confine the present inquiry to the two last alone, that is, to those diseases which arise from the state or altered course of the bile.

First, I shall speak of those cases in which the *natural course of the Bile is deranged*.

When any obstruction is made to the passage of the secreted bile out of the body, it is carried into the mass of

circulating blood, to which it gives, by solution in the serum, its own yellow color. The blood thus tinged, carries the dye with it to every part of the body, and the general hue is produced which constitutes jaundice.

It is scarcely necessary, under the present impression of the agency of the absorbents, to state, that they are the medium by which the bile, under these circumstances, enters the blood vessels. But I have taken advantage of the examination of one jaundiced patient, to notice the state of the thoracic duct, and saw evident and satisfactory marks of the presence of bile in it. Dr. Saunders*, of whose accurate and scientific work upon this subject it is impossible to speak too highly, observed the same yellowness in the absorbents and thoracic duct of a dog, in whom jaundice had been previously produced, by a ligature upon the common duct. He likewise examined the relative state of

* Treatise on the Liver, p. 91.

the blood contained in the hepatic veins, and in the other veins of the body, after the obstruction had existed a short time, and found that the serum of the former was evidently more loaded with coloring particles of bile than that of the latter. From hence it may be inferred, that in a liver distended by bile, the distension is not only relieved by the powers of absorption, but by an impulsion of the distending fluid into the mouths of the hepatic veins, and that the bile reaches the blood by each of these channels.

When it has reached the circulation, the intensity of tinge which different parts receive, will be in proportion to their vascularity, and the quantity of coloring matter thus carried to them. All the solid parts of the body, except the medullary substance of the brain, even the bones themselves*, and the fat†, have been noticed as receiving an occasional tinge; but the point in

* Van Swieten, Sect. 950. Stoll Ratio Medendi, p. 3, Sect. 5.

† Morgagni, Epist. 37.

which the circulating bile is first and most clearly perceptible, is the sclerotic coat of the eye, whose white natural color differs more from that of the bile than any other part of the body. Indeed this is frequently the only point on which our determination of the nature of the disease turns; for there are other complaints, as some cases of chlorosis, in which the whole body assumes a yellow color, such as might lead us to suspect the presence of bile, rather than that it was derived from any other cause; but in all such cases, the original whiteness of the eye remains, and assures us, that the circulating fluid holds no bile in solution.

It may be well also to mention here that discoloration of the eye, which accompanies some diseases of the liver, and leads us to infer their existence, though it can scarcely be said to amount to jaundice. Dr. Darwin* has aptly and ingeniously termed it *bombycinous*, comparing it to the yellowish blue and semi-

* Zoonomia, Vol. I. p. 354.

transparent appearance of a full grown filk worm. The eye itself seems to be altered from its natural look, and to have superadded thereto the slight yellowness of a small portion of circulating bile, which, though universally present, is too small to be discoverable in any other part. As the disease, occasioning this symptom, increases in intensity, it very frequently grows into a permanent and fatal jaundice, sometimes requiring a considerable time, and as it were creeping on, and at others advancing with great rapidity.

The secreted fluids, in cases of jaundice, are very generally tinged deeply; indeed the milk is the only exception which is made by authors, and the affection is supposed to extend even to the semen*. In cases of some duration the perspirable matter is colored, so also is the saliva, which has a very bitter and bilious taste; but the urine is much more highly impregnated with bile, and more speedily than any other

* Van Swieten Comment. T. III. p. 141.
Heberden, Med. Transf. Vol. II.

of the secretions; its color, and the effect of a dye which it has upon immersed linen, being among the common tests to which observation recurs in the more early stages of the complaint. Poetic licence seems to have got the start of common observation, in affirming, that this effect is extended to the aqueous humor of the eye *, for, as far as modern enquiry has gone, neither of the humors nor the cornea have appeared to be colored, so that objects have not been seen through a yellow medium, or received a consequent tinge from it. I have always myself asked for this symptom, and have never found it †; not but what it is a case of possibility, and more particularly so where the disease has been

* *Lurida præterea spectant quæcunque tuentur*
Arquati. *Lucretius, Lib. IV. v. 333.*

————— to the jaundic'd eye
All things seem yellow.

Shakespeare.

† Dr. Heberden says, that all the jaundiced patients whom he ever asked denied the truth of this pretended fact, for which (he adds) it is not likely that there was any just foundation. *Med. Trans. Vol. II. p. 132.*

of very long continuance and great intensity, and we must not lightly reject the testimonies of Galen, Hoffman, Boerhaave *, and Sydenham †, who assert that they have occasionally seen it.

The fluids which are often preternaturally collected in the cavities of the body, are also found tinged with bile, as more particularly those serous effusions which constitute dropſy, a diſeaſe connected very frequently with jaundice; and thoſe collected in bladders upon the ſurface in conſequence of the application of bliſters, or other acrid matters, to the ſkin ‡. So even is that fluid, which, under ſome circumſtances, is accumulated in the ventricles of the brain; and this is rather a curious circumſtance, as this differs in its nature from the effuſions into other cavities, even when both have evidently conſtituted a part

* * Nos tamen binæ exempla in ætate virili conſtitutis obſervaviſſe teſtamur.—Hoffman Med. Rat. T. IV. Par. IV. p. 302.

† Flavo quidem colore objecta omnia apparent afflictiſ ſinſta.—Proceſſ. Integ. de Ictero.

‡ Memoires de Medecine, Vol. VIII. p. 127.

of the same disease. In illustration of this I can mention a case of general dropfy, succeeded by apoplectic symptoms, which destroyed the patient; and the only evident cause of this pressure had been the accumulation of a considerable quantity of water in the ventricles of the brain. Though the general effusion consisted of the common ferous fluid, coagulable by heat, alcohol, and acids, the contents of the ventricles were not similarly affected thereby; this difference, perhaps, arose from the comparative smallness of the vessels by which the secretion was made, and it only consisted in the want of this coagulable matter, for the salts, which are held dissolved in the serum, impregnated both one and the other of the fluids. As, therefore, the bile passes through vessels which retain the coagulable matter of serum, and allow the transmission only of the aqueous part, and the matters dissolved therein, I mean to infer, that the state of existence of the bile in the watery contents

of the blood vessels is not a mere diffusion, but, like that of the saline matters, a perfect and compleat solution.

Such obstruction, arising as it may from a variety of causes, is absolutely necessary for the production of jaundice. It never accompanies those cases of immense secretion of bile which are called cholera, at least I have never seen it in very violent ones, nor do I know any author who mentions it even as an accidental symptom; and if it had happened, it could not possibly have been overlooked*. I doubt, as far as I have myself observed, whether the yellowness which Sydenham has described as attending some continued fevers, under the name of jaundice, accompanied by abundant dejections of bilious fæces, did not rather depend upon a high degree of that discoloration of the skin,

* Bianchi gives a case where this circumstance was more narrowly investigated, for he examined the lacteals of a man who had died from cholera, and found that their contents were not in the least tinged by bile. *Hist. Hep.* p. 93.

which, in various intensities, accompanies fever.

The abundant opportunities which European practitioners have had, within these few years, of observing the symptoms of that dreadful disease of the West Indies, the yellow fever, have established it as a fact, that the strong discoloration which there takes place does not depend upon bile *. It does not appear in the same parts of the body, or observe the same gradations in its progress, that jaundice does, for the first yellowness is perceived along the neck in the course of the jugulars, and running along the cheeks in an angle from the nose, irregular tinges pass along the breast and back, and the feet are often deeply colored before the rest of the body is materially affected. Besides, from the time of Hippocrates †, an attack of jaundice,

* Maclean on the Diseases of St. Domingo, p. 34.

† Οκοσσοισιν εν τοις πυρετοις τη εβδωμη η τη εννατη, η τη ενδεκατη, η τεσσαρακαι δεκατη ιατρει επιγινονται αγαθον, ην μη το δεξιον υποχονδριον σκληρον η, ην δε μη, εν αγαθον. Aphor. 64. Sect. 4.

towards the end of fevers, has been considered as a favorable prognostic, with one very wise exception of those cases where there is organic disease of the liver; but in the yellow fever this symptom does not appear to have been connected with any striking affection of the liver, and yet the indication was fatal.

There is also another deceptive discoloration of the skin, which has been often considered as jaundice, which it is right to mention. It rather appears to be analogous, when it does occur, to that of fever*. Galen first supported the

* It is remarkable that Galen (De Locis, Lib. v. Cap. 8.) does not consider this as proceeding from the passage of bile from the liver to the skin, but from a change in the blood circulating there. *Ορξται δε και χωρις κρισεως εκχολημενον ενιοτε το αιμα κατα τινα διαφθεραν αλλοκοτον, οποια και θηριων δακνοντων γιγνεται.* The anti-ents were led, by the yellow color of the serum of the blood, to suppose that the bile existed ready formed therein, as one of its principles, and that the office of the liver was to concentrate these diluted coloring particles, which, on their separation from the phlegm, or aqueous parts, acquired the more intense color of bile.—Galen Comment. in Epid. 3.

It is odd that Van Swieten should exemplify the jaundice, occasioned by the bite of poisonous animals, by one

opinion that jaundice was occasioned by the bite of poisonous animals, and there can be no doubt of the fact that some discoloration does ensue, for it is mentioned by other writers, and above all, by Fontana, but it is not a constant or even common phænomenon; I have watched for it in the adnata of animals, bit by a viper, without observing it, and neither Mead nor Lanzoni, nor Fontana, give those minutiae respecting the yellowness, which can enable us to form a correct judgement. Fontana supposes as its cause a stoppage of the biliary duct, from convulsive contraction of the duodenum*; and says, that the same symptoms follow other poisons also; if it be so, arsenic which is immediately applied to the stomach, and which produces violent convulsion of that viscus and the intestines, would a priori be considered as

which followed the bite of a cat from Lanzoni, and another that of a dog from his own experience. Comment. Sect. 916.

* Fontana on Poisons, Vol. I. p. 82.

most likely to produce it; now I myself have a recollection of three such cases without any icteric symptom, and neither Morgagni, nor Lieutaud, nor Wepfer, who enumerate the symptoms of this poison, notice it*.

Of the *Causes* which obstruct the passage of the bile out of the body, the presence of a concreted and solid substance of any sort in the duct, is the most evident and striking, and it is likewise very common. Biliary concretions are often formed in the bladder, and sometimes pass from thence through the duct into the intestines. The nature of these, and their relation to healthy bile, are to be considered hereafter, they are now only to be mentioned as a mechanically obstructing cause.

Supposing then a concretion of this sort to enter the cystic duct, its effect upon it will be in proportion to its size,

* Morgagni, Lib. ix. 3. 6.—Lieutaud Anat. Med. Vol. I p. 39. Obs. 134.—Wepfer de Cicut. aquat. c. xxi. 3.

so too will the length of time it will take in passing onward, but, generally speaking, there will be no jaundice till it has quitted the cystic and entered the common duct; or rather, perhaps, till it has reached the extremity of the cystic duct, which, by its distension, must affect the passage through its neighbour; for in the first period of its progress it does not intercept the passage from the secretory organ into the intestines, and therefore does not prevent the departure of the bile from the body: that it cuts off the communication between the liver and its reservoir is not sufficient for this effect, at least in any striking or permanent degree, for after an obstruction has existed in the passage of the cystic duct, the bile, which was contained within the bladder, is found to have been absorbed, and it is then distended by its own peculiar secretion. If I am right in supposing the expulsion of the concretion to be principally made by the contraction of the bladder, then its entrance into the cystic duct implies an

evacuation of its contents; it is therefore probable that the quantity of bile remaining in it is very small indeed, that is, too small to produce, by its absorption, any noticeable discoloration; but as the bile so situated is found, when the obstruction has existed long, to have been entirely removed, it will have produced some effect proportioned to its quantity, though M. Portal gives an account of an experiment in which he made a ligature upon the cystic duct of an animal, and no jaundice followed*.

When the gradual distention of the duct has allowed the entrance of the concretion into the common channel, the passage of the bile is so blocked up as necessarily to produce jaundice; but it has been supposed even in this case, and during the decided presence of the obstructing cause, that the obstruction itself is not permanent, the duct, like muscular canals, ceasing to contract after the stimulus has been long ap-

* Memoires de l'Academie, 1777.

plied, and allowing the passage of the bile round the sides of the concretion; now this seems scarcely to be possible, for when such relaxation of action does take place, which it is probable it does in some degree, the obstruction to the passage of the concretion is removed as well as to that of the bile; it therefore, and more especially if the duct be turgid behind, must be impelled forward, and be thus applied to a new surface, capable of being excited into action by its presence.

Spasm of the duct is another cause of obstruction, the agency of which, to my mind, seems well established, though it has often been denied; but even if we do not admit the existence of a sufficient contractile power in the duct itself to produce this effect, it may be accounted for from the affection of the muscular coat of the duodenum, through which it passes. In some way or other, however, jaundice is the frequent attendant of diseases which are called spasmodic; thus it sometimes comes on

during the paroxysms of hysteria, and is sudden in its attack, and of short duration; it also follows violent fits of rage, and other mental affections*. It has been supposed that, during the general commotion of such circumstances, a concretion may have been pushed from the bladder into the duct, and that the disease may have produced the jaundice in this way only†; but it often happens that there is no reason to suppose the existence of such concretions, and that none are found in the fæces after the symptoms have subsided, nor on examination after death, where it has proved fatal; the whole attack also has been too transitory, and too free from the general signs of the passage

* *Familiares ex mentis pathematibus ictericæ sunt.* Bianchi, p. 220.

† Morgagni gives two dissections where jaundice had followed an affection of the mind, in which no concretions were found on examination. Ep. 37. Art. 2—4.

Cullen appears to speak much too strongly, when he says, in ninety-nine of one hundred instances of this disease the passage of the bile is interrupted by biliary concretions, formed in the gall bladder, and falling down into the ductus communis. *Mat. Med.* Vol. I. p. 150.

of a concretion, to allow a supposition that such was its cause.

Plethora of the vessels of the liver is another probable cause of jaundice, for it may easily be imagined that a larger than the natural quantity of blood circulating through this viscus, may press upon and block up the biliary ducts, and thus occasion the absorption of that bile to whose secretion it ministers. In hepatitis this circumstance occurs, for more blood passes through the vessels of a part when inflamed than does in a healthy state; and, according to Boerhaave*, this disease is occasionally attended by jaundice; other authors mention this as a rare occurrence, and when it does happen, have rather explained it by supposing the inflamed part to be so situated as to press, by its increase of size, upon some of the larger branches of the biliary ducts; the inflammation of the liver is never, I

* Aphorism, 918.—Fernelius, in his Pathology, says, that he scarce found one case in ten of Hepatitis accompanied by jaundice.

believe, general, and we therefore cannot expect to meet with instances of general distension of the blood vessels from a partial affection ; but if my idea, that the bulk of the whole liver is frequently enlarged from the existence of some obstruction to the lesser circulation, be just, we shall have abundance of cases of general accumulation of blood in it, and if distension be a sufficient cause, may expect to meet with some accompanied by jaundice. I examined the body of a woman who had died of phthisis, and whose lungs were almost one mass of ulcerated tubercle ; within the last three days of her life, jaundice had come on to a very intense degree ; there was no cause affecting the common duct, for the bladder was empty, nor was there any discoverable in the hepatic duct, as far as I could trace it ; the lymphatic glands in the portæ were not præternaturally enlarged, nor could any external tumor be discovered. It therefore seemed that the cause was to be sought within the substance of the

liver; throughout it was much increased in size, it had a loose texture, and doughy feel, and was, in every part, deeply tinged with bile; there seemed, therefore, to be a great accumulation of blood within the whole viscus, which had at last proceeded so far as to obstruct the biliary ducts, and thus produce the jaundice. Sauvages*, one of our best systematic writers, ranks plethora among the causes of this disease, and gives an explanation of its agency, somewhat similar to that I have now offered. Jaundice also occurs occasionally towards the end of pregnancy, and this probably arises from a similar source, and it is the more likely for this to be the case, because evacuations, and particularly blood letting, remove it.

* Sauvages Nosologia Methodica, Vol. II. p. 589. Aurigo plethorica.—Inter principia auriginis primum est plethora seu major sanguinis & humorum quam natura fert copia, cum enim circulatio sanguinis per hepar sit tardior quam in aliis partibus, quippe cum sit in vena porta jam retardatus, cum a mole nimia sanguinis cordi resistantiam offerenti ulterius in hepate retardari, & ipsum sanguinem inspissari necesse est, unde supprimitur bilis secretio.

The intermittent fevers of this country, and the analogous remittents of warmer climes, are often accompanied by true jaundice, and when this happens towards their end, it is considered as affording a good, rather than a bad prognostic. There does not generally, in such instances, appear to be any other disease of the liver than the increase of its size, with great accumulation of blood through its substance, and it is probable that the plethora, thus existing, may be sufficient for the production of the jaundice which occurs.

Among the more rare cases of obstruction in the duct may be ranked a sufficient thickening of its coats, to which Morgagni refers*, and which Dr. Darwin imagines may be occasioned in a sufficient degree by a thickening of the membrane lining the ducts, analogous in its kind to that of the membrane of the nose in catarrh, and which, like it, soon ceases, and the jaundice goes off†.

* Morgagni de Caulis, &c. Ep. 37. Art. 10.

† Darwin's Zoonomia, Vol. II. p. 138.

The cavity of the duct may also be perfectly obliterated, as it is stated to be by Morgagni, but this is a very rare occurrence indeed. Dr. Baillie* never saw but one instance, and that was of the cystic duct; where it happens to the common duct jaundice must necessarily follow.

Greater density of the secreted matter of which I have spoken, among the morbid alterations, and which is readily absorbed, does likewise occasionally produce yellowness of skin, whiteness of the stools, and all the phænomena of jaundice, among the causes of which it ought therefore to be enumerated.

Enlargements of the neighbouring parts, as schirrus of the head of the pancreas, or scrofulous increase of the lymphatic glands in the capsule of Glisson, are common occurrences, and frequently are so situated as to obstruct me-

Dr. Saunders has frequently seen the ducts of drunkards so contracted and thickened, that they could not transmit bile. *Treatise on the Liver*, p. 184.

* Baillie Morbid Anatomy, p. 159.

chanically the passage of the bile into the intestines * ; even similar affections of some parts of the liver itself operate as extraneous causes, from their local situation, and stop the natural course of the bile ; but schirrus is not usually a general disease of the substance, it is confined to particular spots, of greater or less extent, and it not only obliterates the passage of the ducts, but destroys also the secreting vessels of the part it occupies, and thus counteracts, in degree, the absorption it would occasion, by preventing the secretion of any bile to be absorbed ; it is only where, by its local situation, it obstructs some of those ducts which have already received bile from some healthy part, and are making their course towards the larger trunks, that it produces jaundice, and we often see that it has made considerable progress without any such consequence.

* In a subject which Mr. Macartney examined for me, an hydatid, of large size and firmness to the feel, situated at the root of the mesentery, was the obstructing cause of a permanent jaundice.

Literary men, and those engaged in many sedentary occupations, yield very generally to a curved posture of the body. It should seem that such a posture alone, independent of the more remote effects of such modes of life, was sufficient for the production of jaundice. That it is a disease peculiarly common under these circumstances, is a well known fact, but how far posture alone may be sufficient, and if it be, in what way it produces this effect, may be the subject of speculation. In the necessary attention to anatomical dissection which is given by young men in their preparation for the profession of physic, it is by no means uncommon to find attacks of jaundice, and that too at so early a period of their confinement, as can scarce admit of the supposition that it is acting as a remote cause; and, in some cases of literary attention, the same fact holds good; now the only circumstance in common in these two situations is the flexure of the body forwards; and it has been also the only circumstance to

which I have, in such cases, more than once felt myself justified in attributing the complaint.

Distention of the large intestines by air, which constitutes the disease called tympanites, has often jaundice for an attendant symptom, as I have once myself seen in a very high degree. Such a distention would, when it had arisen to a certain point, impede the influx of bile into the duodenum, by its pressure upon it, and upon the common duct, and I believe it only takes place when the distention is very considerable, and that on this account it may be considered as an unfavorable symptom. In the case to which I allude, the accumulation of air* was so great, that very speedily after the appearance of jaundice the cæcum was burst by it, and the patient of course destroyed.

It is farther a question whether the production of jaundice is confined to

* I examined the air in this and in another instance of the same disease, and found it to consist of seven-eighths of the azotic gas, and about one-eighth of carbonic acid gas.

the obstruction of the passage of the bile into the intestines ; or whether any obstruction to its passage out of the body after it has cleared its appropriate ducts, and reached the intestinal canal, may not likewise excite its absorption into the system and its necessary consequences ? Such obstructions do often occur, as in cases of volvulus, or hernia of the intestines, and in many instances of very obstinate costiveness from other causes ; but it does not appear that jaundice is by any means a common attendant on such complaints, however probable it may seem that it should be so. I believe, however, that this does sometimes happen ; that such obstruction not only may, but does, occasionally, produce absorption of bile from the intestines, and that the jaundice has been a symptom, rather than a cause, of some of the cases of obstinate costiveness on record, especially of those where the yellowness has vanished after stools have been once obtained.

From an analogous infarction of the intestines of newly born children does their jaundice appear to arise, and not from any peculiar obstruction in the ducts themselves; there is a general torpor of the abdominal viscera during the foetal state, the urinary and gall bladder are turgid with their contents, without contracting; the intestines are indolent, and do not expel the fluid secreted into them, till the motion of respiration brings the whole of these parts into action. The contraction of the gall as well as the urinary bladder, is assisted by the pressure thus produced; the whole of the contained bile rushes at once into the intestines, and if the quantity of mucus there accumulated retard its course, the absorbents are roused to exert their office for the removal of the distention, and the bile is carried into the circulating blood. It is in proof of this opinion, that when children have motions soon after birth, such discoloration never follows.

It sometimes, however, happens that the bile is regularly secreted, but that it is retained in the body, and the stools pass colorless without any discoloration of the skin; this is the case in that disease of the gall bladder in which its powers of contraction are wholly lost, and which may be considered as a paralysis of it, such as sometimes happens to the urinary bladder, between which and the gall bladder there are many strong analogies. The accumulation in these instances has not unfrequently arisen to such an extent as to form a tumor externally, with an evident fluctuation, which has induced the surgeon to puncture it under an idea that the collection was matter*. Nor, indeed, if the stools are not colorless will the

* Edinburgh Med. Essays, Vol. II. Art. 30.—Mémoires de Chirurgie, Vol. II.

Galen was aware of this disease, and reckons the distention of the gall bladder among the causes of jaundice—*εγγλωρει δε ποτε και πληρω θεισειν αυτην, ωσπερ η κροδοχος κυστις κενον, μη δυνασθαι κενωθηναι δι εμφρεξζιν η ατονιαν της εκκριτικης δυναμεως. De Locis, Lib. 5. ad finem.*

Van Swieten Commentar. Sect. 950.

distinction between the two cases be easily made; if however the tumor has been preceded by inflammatory symptoms, and that throbbing sensation which attends the formation of matter, its nature may be judged of with certainty, but the want of such preceding symptoms is no criterion, for the appearance of abscess is sometimes the first mark of disease in the liver. Tumors of this sort are said to have yielded to the pressure made on examination, and to have vanished by its continuance, with the discharge of an immense quantity of bile by the intestines; this goes to prove that no obstruction, or a very slight one, existed; it proves likewise that the bladder, in its healthy state, contracts for the expulsion of its contents, and that when its own powers are lost, its relation to the neighbouring viscera, and connection with the motion of respiration, which have subsisted in their regular routine through the whole progress of the complaint, are not alone sufficient for the purpose; it shows,

moreover, that a diseased state of the absorbents of the gall bladder can, under circumstances otherwise favorable, prevent an attack of jaundice.

It happened to me to meet with two cases within a short time of each other, where a jaundice of some continuance was succeeded by decided apoplexy and death; the patients were both females and young, and did not appear likely to be affected with such a disease as apoplexy. I regretted that circumstances prevented an examination of these cases after death, because I could not help suspecting more than an accidental occurrence between the two diseases. The oldest writers on medicine have supposed a mutual sympathy of this sort between the liver and the head, which seems to be supported by a number of cases on record, as well as those I have mentioned. Baglivi gives a very similar instance, and Morgagni more than one; his also were examined by dissection, and it scarcely seemed that the morbid appearances of the brain were

sufficient to produce the symptoms. In one there was but a trifling gelatinous effusion, and in another only a fullness of the vessels, which he suspected to be preternatural*.

The symptoms of jaundice are considerably modified by the cause which has produced it; but there are some of them which are constant, and which depend upon the presence of this extraneous fluid in the circulation, and its absence from the intestines. Omitting the obvious discoloration of the surface of the body, and loss of the natural color of the stools, these are languor of pulse, great depression of strength, and inaptitude to exertion, lowness of spirits, bitter taste in the

* Icteri nunquam spernendi nam sub larva & persona icteri, sæpe magni periculosi & repentini morbi absconduntur, & sæpissime moriuntur derepente icterici, ut ait Dodæus. *Baglivi Præcos*, Med. Lib. 1.

Baglivi gives a case of apoplexy succeeding to jaundice, p. 433.

Κακὸν δὲ καὶ ἐπὶ ἰκτερίῳ καφῶσις.

Prædict. Lib. I. Sect. 4.

Κακὸν δὲ καὶ ἐπὶ ἰκτερίῳ μωρώσις.

Coac. Prænot. Sect. 2.

mouth, and great thirst ; a troublesome sense of general itching over the skin, attended by some elevation of points, which, in the recourse which is had to scratching for relief, are more readily broken than the surrounding plain, and form coagulated scabs with a trifling surrounding inflammation.

It is generally stated, and as generally believed, that costiveness is a necessary consequence of a want of bile in the intestines, and from this circumstance it has been asserted, that the great use of the bile is to stimulate the intestines. If the position was founded in fact, the inference would be just, but, I think, this will admit of doubt. In truth, with the greater number of patients I have seen, the contrary has been the case, they have been rather purged than otherwise ; and most of the clay colored stools of this disease, at which I have looked, have been remarkably soft in their consistence. Nor is this observation singular or new ; the

learned Dr. Heberden's * experience led him to impugn the common opinion respecting this use of the bile upon the same ground. Sometimes, however, a very obstinate costiveness does most certainly accompany jaundice †. I know not whether the distinction will hold, but I have fancied this to be more particularly the case in the jaundice of old people and dram drinkers, whilst younger patients have most commonly been purged. But the very degree of this symptom, as it is described by authors, and as I myself have seen it, militates much against the want of bile in the intestines being its cause. Sup-

* Med. Transactions.

† Phil. Transf. Vol. VII. p. 571. Van Swieten gives a case of obstinate jaundice succeeding an intermittent, in which no medicine, not even tobacco smoke, produced any evacuation, and the patient died after eleven weeks.

Phil. Transf. N^o 414. A man had a wound in the gall bladder, and consequent effusion of the bile it contained into the cavity of the abdomen, he suffered from incurable costiveness, and his intestines were so much distended with air, that before the body was opened tympany was suspected. Dr. Whytt (Works, p. 50,) considers this inflation of the intestines as especially taking place in those who die of inveterate jaundice.

posing, for a moment, that bile is the stimulus imagined, it acts with a definite force, exemplified in the daily occurrence of stools; now, under these circumstances; any common purgative stimulates the intestines still more, and produces more copious evacuations; but when bile is absent, and there is costiveness, even the strongest purgatives fail of their effect, though, as far as their stimulating power goes, they must infinitely surpass any quantity of the bile itself. If, too, this deficiency was the sole occasion of so unpleasant a symptom, it might be thought that the bile of animals might be advantageously employed for its removal, but even this does not answer, nor has a scruple of inspissated ox bile stimulated my own intestines to more frequent or copious discharges. Upon the whole, I think that costiveness ought not, in this case, to be attributed to absence of bile, and that bile is certainly not the stimulus which has been imagined.

WE next come to those diseases which depend upon a *morbid alteration of the bile*; of these the first, and perhaps the most important, is that *tendency to form solid masses, which afterwards act mechanically in the production of great and serious inconveniences.*

In by far the greater number of examinations in which I have seen biliary concretions, their presence had not been suspected during the life of the patient, so little peculiar derangement had they produced. They have sometimes, but very rarely, occasioned ulceration* of the inner coat of the bladder, and given birth to the train of symptoms which must necessarily attend such a case; but it may be stated generally that, during their continuance there, they are harmless†, and that much inconvenience only

* Dr. Soemerring has seen a good many instances of ulceration in the inner surface of the gall bladder, from the irritation of gall stones. *Baillie's Appendix to Morbid Anatomy*, p. 80.

† Si fuerint in vesica, signa ipsorum difficilia sunt, obscura, & vix humana mente investigabilia. *Baglivi Opera*, p. 434.

attends upon the accident of their being carried from thence into the narrower ducts, whose cavity must be distended for their passage, if they are of any size.

From considering the circumstances of these concretions in the bladder, it seems probable that no other cause can bring about their entrance into the duct but the contraction of the bladder itself, and that the position of the body, which has been supposed to operate in placing it in this situation, has nothing to do with it. Concretions of large size, large enough that is to obstruct the ducts most completely, are generally lighter than water; if so, they would of course rise to its surface, and if the gall bladder was filled with water only an upright position, in which the neck is higher than the fundus, would be more unfavorable than a contrary one; but the cystic bile, in which these concretions float, is a thick ropy fluid, particularly so too where they are present, and this would by no means admit of

the operation of flight differences of specific gravity. It is probable that the evacuation of the gall bladder is only partially made, and its surface is defended by a very thick mucus, so that a concretion may be supposed to exist for a great length of time, enveloped as it were in the fluid contents, without impressing upon the bladder such inconvenience as to excite the necessity for its removal, and that it does so at any time may depend more upon accident than the operation of regular causes. There seems to be an established principle in all the canals of the body, by which their contents are uniformly protruded one way, independent of gravitation or any other external cause, and this principle acts in the passage of the concretion, for it is carried along the duct towards the intestines, by an action which the stimulus of its presence excites, and the existence of almost a reasoning power, which regulates the actions of those parts of the body which are not under the influence of

the mind, is more particularly visible in this instance; for with respect to its own natural fluid the duct allows a passage through it both to and from the bladder, but with an extraneous body once impacted, it does not seem to admit of recession.

It has been imagined that the degree of angularity of these concretions must considerably influence the symptoms they produce, it being a form more particularly calculated to occasion pain in parts to which it is applied; this scarcely however appears to be the case, for their angles are never sharp enough to cut, or their points to perforate; but I am more particularly inclined to think that shape does not affect their symptoms, from remembering that the sharpest pointed and most jagged urinary calculus I ever saw was not suspected to exist, and produced not the least uneasiness till the bladder was accidentally examined after death.

Size is a matter of more importance in general than shape, for in proportion

to it will the distention of the duct, and the difficulty of the passage of the concretion be greater or less; but even this is of less consequence than one might at first imagine; for very small and round concretions, whose consistence too has been soft, have occasioned great violence of symptoms in some cases, and in others large and angular ones have been passed with a much less degree of inconvenience.

In this, as in every other instance of disease, the state of the subject acted upon very essentially modifies the effect of any given cause; we know not, however, the source of these peculiarities in individuals, or more than the certainty that such do exist.

The violence of any single attack may also be considerably influenced by preceding circumstances. The duct, when it has been distended by the passage of a large concretion, does not soon return to its original dimensions; authors mention it as being found, in some instances, of a much larger

size than natural*. The protrusion, therefore, of one concretion would facilitate the passage of subsequent ones, and even if its size was the same, the second would, under these circumstances, produce less mischief than the first.

The symptoms which arise will be best described by taking the most violent cases, which are not commonly met with, and allowing in the opposite extreme for the passage of the concretion without the attendance of a single symptom, and in intermediate ones for every possible variation in degree.

They may be divided into such as depend upon the distention of the duct, upon the sympathy of neighbouring or distant parts, and upon the obstruction to the passage of the bile.

The attack often commences suddenly, with shiverings, which after-

* Baillie Morbid Anatomy, p. 159.—Van Swieten Commentar.—Vicq. d'Azyr Mem. Par. Vol. III. p. 220, —Heberden Med. Transf. Vol. II. p. 135.—Heister Acta Natur. Curios. Vol. I. p. 404.

wards occasionally recur ; a violent and acute pain at the pit of the stomach, more so apparently than that which attends upon acute inflammation ; this pain seems generally to be confined to that point of the epigastric region which very accurately corresponds to the situation of the opening of the common duct into the duodenum, and from hence it appears to dart through to the back ; the pulse is very little increased in quickness or in strength, and has none of the hardness which attends upon inflammations ; the breath becomes short and hurried ; there is great general anxiety and restlessness, often amounting to delirium, and at last great depression and fainting ; the stomach is affected by nausea, and there are frequent efforts to vomit. These symptoms, however, last not long in all their fury, soon remitting and allowing shorter or longer intervals of ease, during which no acute pain is suffered, but there is a sense of deep seated foreboding and fullness of the epigastric and

right hypochondriac region ; the patient keeps the body bent as the position attended with most relaxation of the affected parts. Another fit, perhaps of equal or greater violence than the first, then comes on and alternates with another remission, and after an uncertain number the more urgent symptoms suddenly cease, the soreness and uneasiness gradually, but quickly, diminish, and the patient is restored to ease.

At some early period of these attacks the jaundice makes its appearance, and continues for a considerable time after the violent symptoms have departed, producing its usual inconveniences ; it may soon, however, when the concretion has passed, be perceived to diminish in its intensity, but before it will entirely disappear it requires that the whole quantity of the tinged serum be removed by a gradual dilution, with a fresh supply in a natural state.

Inquiry sometimes shows that these attacks have been preceded for several days, or even weeks, by a sense of

fullness and uneasiness about the stomach and region of the liver, especially after eating, but neither sufficient in duration or degree to excite alarm, and the less so as it has yielded, for the time, to some domestic spirituous remedy.

It is impossible for those who have witnessed the progress of a natural labour not to be struck with the resemblance which many of its symptoms bear to those of this disease; it is indeed the term of comparison to which females have recourse to express their sufferings. The attacks of each consist in the same efforts to expel an extraneous body, and in the same violent distention of a passage, but they differ in circumstances dependent upon the peculiar situation of the part affected.

The pain is clearly referred to one spot, and that most probably not the actual one, where the concretion is present, but in whatever part of the duct that may be, the sensation is at the termination of the canal in the duodenum. It rarely happens that our

own feelings accurately indicate the part affected, and we are often obliged rather to trust to the sympathies of distant situations for our knowledge of diseases. That of which we are now speaking, which refers the pain arising from an affection of any part of the biliary duct to its terminating point, has a strong analogy in many of the various diseases of the urinary bladder, in which there is a striking uneasiness of sensation at the extremity of the penis. In acute inflammations of the liver itself, as in some cases where it has been wounded, and it is said occasionally too from the passage of concretions, the pain is felt chiefly at the tip of the shoulder, and sometimes this has been the only spot of which the patient has complained*. In the several cases

* Some of the old authors attribute this symptom to the increased weight of the liver drawing downwards the membranes which line the thorax. *N. Pifo de cognoscendis & curandis morbis*, Lib. iii. cap. 25.

I once saw a case of wounded liver where this was the only source of inconvenience, without any reference to the part actually affected.

of colic, in whatever part of the canal the disease may actually exist, it is referred to the region of the navel. That these sympathies are established as facts, by observation and experience, is all we know of them, nor does the connection of particular nerves, or any other theory which has been invented, give even the shadow of a satisfactory explanation.

With respect to the nausea and vomiting which occur, we may notice the remarkable sympathy of the stomach with the affections of other, even distant parts, and more especially with these important organs which are situated in its neighbourhood. The liver is a very large mass, and it does not appear that the stomach is affected by diseases of its superior and distant surface, but only by those which lie contiguous: thus the schirrus, which follows the abuse of alcohol, is generally attended by dyspepsia, which is its worst and most troublesome symptom, and I have thought that this sort of schirrus usu-

ally begins in the parts of the liver contiguous to the stomach, and that it can be first and best ascertained by examining that part which lies near it in the epigastric region.

The duration of the attack, considered as including the whole time of the passage of the concretion, is as various as its intensity; sometimes a few hours, sometimes several days, or even weeks, elapse before it is expelled; in the former of these cases it is often so rapid as not to allow time for the jaundice from obstruction of the duct, to take place, though the other symptoms are sufficiently marked and acute. Now in the absence of so decisive a symptom, we should be cautious in forming an opinion of the cause of the attack, and even where it does attend, should direct a careful examination of the fæces, to discover the concretion which may have passed among them out of the body.

Concretions have occasionally been passed, of the nature of which there

cannot be a doubt; but which, from their size, never could have passed through the gall ducts. I have seen single pieces of such, which were more than an inch in their diameter, and three inches in length; these then must be supposed to have passed directly from the bladder to the colon, by a previous adhesion, and subsequent union of the two cavities, as happens in many cases of abscesses of internal parts. As far as the absorption of parts is concerned, pressure is often sufficient to excite it, without any general derangement, but such a passage of concretions implies another action, that by which adhesion is formed, taking place, for it is necessary that the peritoneal coat of the bladder and that of the gut should unite; this I believe cannot happen without inflammation, and if it cannot there must be sufficient peculiarity of symptoms in such a passage to characterize it; but I speak doubtingly, for I have never seen a case where it was suspected. Or there may be another

opinion entertained, that the concretion, though evidently biliary, may have been formed or increased considerably in its size in the intestinal canal, and not in the gall bladder. Either case is possible, but the former is the most probable, for those calculi, which are sometimes found in the intestinal canal, have their nucleus encrusted with peculiar saline matter, and if even a biliary concretion remained long in such a situation it would probably become the central point of a similar deposition, rather than of bile, or at best be mixed with it, and in the largest biliary concretion that I have examined there was no such appearance.

Another effect of biliary concretions is that they are occasionally connected with entire obliteration of the cavity of the bladder, and remain impacted in its neck without the production of any noticeable inconvenience. I state this on the authority of a case Mr. Crowther and myself examined, the subject of which had died of complaints uncon-

ned with the liver; a single concretion of no large size had lodged in the neck of the gall bladder, whose cavity was so perfectly closed that considerable force could not drive the stone back into it, and we almost imagined, at first sight, that the gall bladder was wanting. Its substance, on examination, however, appeared much thickened, and it seemed probable that there had, at some previous period, subsisted an inflammatory action, which had terminated in these adhesions, of which perhaps the stone might have been the original cause.

Biliary concretions are sometimes found lodged in cysts, hollowed as it were out of the side of the bladder, and attended with considerable increase of thickness of its coats; but most commonly they are loose within its cavity, and it is scarcely necessary to observe that these latter alone can be carried into the duct, or produce the symptoms which depend upon their passage.

Concretions of a fimilar nature are faid to be found in the fubftance of the liver itfelf, and plates are given, by by fome authors, representing them as diftending the branches of the biliary ducts * ; but fuch cafes are rare, I have never met with one, and Ruyfch, in all his immense refearches, with only one †. Gliffon fpeaks of an incruftation of the biliary pores in the livers of ftalled oxen, following the ramifications of the duct, and thus, where they could be taken out in a tolerably perfect ftate, refembling the branching forms of coral. He mentions, too, a cafe of depositions of the fize of peafe, abounding in the liver of a ftumous patient ; but of the nature of thefe, and whether they were biliary, or only tubercles,

* Walter Obferv. Anat. p. 46.—Coe on biliary Concretions.

† Vicq d'Azyr gives a figure of one found in the hepatic duct of a horfe. *Mem. Par.* Vol. III.—Obferv. Anatom. xvii. p. 417.

Sunt hi lapides iis qui in veficula fellia reperiuntur plano congeneres & figura folum difcrepant, *Anat. Hepat.* cap. 7. ad finem.

there are not sufficient data to form a judgement.

Sometimes the long continued impaction of the stone in the duct is productive of inflammation and ulceration therein, and has all the lasting inconveniences which such affections produce; and it has happened that the duct has burst during such impaction, and necessarily excited a train of symptoms from its discharge into the cavity of the abdomen, which have soon proved fatal.

When, however, the concretion has once entered the duodenum it ceases to do further injury, and generally passes out of the body with the fæces, but as its passage is often accompanied by vomiting, and an inversion of the natural motions of the stomach and duodenum, it is occasionally brought thereby into the stomach, and discharged by the mouth*. In the latter of these cases

* Hoffman Med. Rat. T. IV. p. 273.—Coe quotes a case of this sort from Dr. Huxham, p. 73.—Burserii Instit., Med. Vol. IV. Sect. 162.

it cannot well be unnoticed by the patient, but it is feldom that the stools receive fufficient investigation for its difcovery, unlefs the fize has produced fome fenfible difficulty on its quitting the body.

These concretions which are found in the gall bladder have appearances fo various as fcarcely to admit of general arrangement.

First, with refpect to their *external form* it may be remarked, that this never takes the definite angles of one regularly formed crystal, and that even thofe which come from the fame bladder, and refemble one another in their compofition, vary fo much, that out of fome hundreds no two will be found bearing that fort of fimilitude to each other which fubfifts among the different crystals of the fame falt. Where a number is contained, their general fhape is fuch as to apply them clofely to each other, and accommodate the whole collection to the form of the bladder. Where they are few and

large, this is sometimes effected by truncating the end of each, or sometimes by rounding the end of one, and hollowing out that of another in a small degree, for its reception; so that by this close application they form, as it were, but one concretion with respect to the bladder. At other times, however, they remain perfectly distinct, and without any marks of their having been in contact*. Where a single one only has been found, and that small in its relation to the cavity of the bladder, it has, for the most part, a rounded somewhat oblong form, and sometimes a perfectly smooth and equal surface, but more commonly it is unequal, and bears, in a slight degree, the appearance of the mulberry, seeming as if it was composed of little agglutinated nodules; this appearance, however, is confined to the surface, and does not affect the interior part; sometimes the nodules are larger, the whole stone

* A concretion of this sort, of the size of a hen's egg, is described and figured in Mem. Par. Vol. III. p. 219.

being composed of only two or three, which give to its surface a bold undulated form, and sometimes they project into sharper and more acute points.

It would be difficult to express the different shades of color these concretions possess; they are sometimes crystals*, colorless, shining, and semitransparent, and vary from hence down to an opaque white; commonly they have some variety of brown tinge running through orange to a light yellow on the one part, or on the other through various intensities of brown to a deep green, or perfect black. In some these colors are mixed in layers on the surface, and more especially in those large ones, which bear marks of close application to a fellow, where the white and brown, and yellow, sometimes run together in irregular marbled veins.

They differ also in their consistence, some have a slight soapy feel, and may

* It is most probable that those which Van Swieten called *gypseous*, solely from their external appearance, were of this sort. *Comment. Sect. 916.*

be scratched by the nail, others are friable, and break into dust on the slightest degree of violence, and others are hard and difficultly broken.

In their internal structure the appearances are more constant, and, under this point of consideration, they may be divided into crystallized, deposited, and amorphous; the two former of these being to be considered, in very many instances, as only different modes of existence of one and the same matter.

Crystallized concretions are not unfrequently found of a lamellated structure, the plates radiating from the centre to the circumference, they have somewhat of an unctuous feel, and look like spermaceti, and the crystals, like it, are easily broken into a greasy sort of powder, these are generally semi-transparent, and but seldom retain their purity throughout, being, near the circumference, mixed with more or less of a brown coloring matter. At the central point of these colorless crystals, to which the radii converge, there is mostly a

small particle of colored matter, resembling bile; sometimes this crystalline shoot, having reached perhaps the size of a pea, becomes itself a centre, around which various depositions are afterwards made, in a more or less confused or regular way.

The radiated crystals are very often deposited in separate strata around any nucleus; these are frequently numerous, laying one upon the other, and the tendency to a regular form is scarcely visible in some; in most of this stratified structure they have also rather a spicular than a lamellated form; the strata are sometimes uniform, and well defined by a deeper line of various shades of color, running between each, and resembling some varieties of the striated gypsum, which lies over salt mines.

Very commonly also the crystalline form is entirely lost, and a confused deposition of the same sort of matter is made, standing to it in the same relation that the common depositions of

carbonate of lime do to its crystallizations. If these be melted by heat, and gradually cooled, they assume the more regular spicular crystalline form exactly. They are of various shades, from white to deep brown, and generally break through their centre on the application of moderate force, discovering a nucleus, for the most part of a deep brown color. In their external form they are usually variously angular.

The mixture of these two modifications of crystallization and stratified deposition allows of very great variety, and the most common of all concretions partake confusedly of both. In the angular and wedge shaped ones, which frequently fill the whole bladder, there is often an internal crystallization, marked by a circular boundary, and then a deposition of several strata growing more and more into the angular form. Sometimes there is only a thin layer of deposition, inclosing a mass apparently of common bile, of various degrees of consistence and solidity, beset

with very small white spots, which, when viewed in a strong light through a magnifying glass, have a beautiful appearance of little crystallized globules.

The amorphous concretions are such as bear no marks of crystallization, or rather regularity of structure, and which seem to contain none of that peculiar matter which characterizes the former; it is upon the absence of this that I would particularly found the distinction. Sometimes, even as they dry, they have a tendency to break into layers, a circumstance which shows the mode in which they were formed; but these layers are very thin and very friable, and have no appearance of crystallized matter in them. For the most part such concretions have an irregular shining fracture, falling into pieces on the application of the slightest force. They are, in their color, commonly black, and may be considered as resembling coal. When they break into layers I have noticed that their external color is very frequently a deep bottle green, or dark

brown, and in some cases they are reddish brown, like clays containing iron, after they have been burnt. Perhaps of these latter there are many more varieties than I am acquainted with, I think indeed that there are, but they are much less common than the former sorts.

Next with respect to the nucleus of these concretions, which seem to be, in every instance, necessary for the crystallized or stratified varieties, though there is none apparently to the amorphous. Sometimes the deposition of this crystallizable matter is made in a thin crust around a soft and porous piece of bile, which is often studded here and there with points of crystallized matter of various sizes; where the nucleus is of bilious matter it often bears a curious appearance, as if it had dried after its first formation, for it is found cracked and shrunk into various irregular fissures, but this seems rather to take place after it is taken from the bladder, and not to subsist when it is fresh, and in its original situation. In the centre of the

crystallized globule there is often a bit of bile inclosed from which the radii have shot.

It is probable, from the appearances which have been described, that many of these stones, which have the radii passing without interruption from the centre to a considerable distance, are almost immediate in their formation, and shoot into that form as soon as a nucleus is offered to them, whilst the subsequent strata are the work of time, and of a series of distinct crystallizations.

Chemists are well aware, in many operations, of the importance of a nucleus to begin that arrangement of particles which builds up a crystal, and its necessity is not less in similar processes within the human body, for without some point to act as a foundation neither the biliary or urinary concretions unite to form crystals. Camper has an experiment strikingly illustrative of this fact, which he gives as follows * : “ My

* Kleinerer Schriften.

“ chamber pot being much furred, by
 “ depofition from my urine, I had it
 “ fcoured quite clean, and befmeared
 “ one half of the infide and bottom
 “ with oil, the pot was daily washed
 “ with warm water, and befmeared in
 “ the fame place with the oil; the fide
 “ where no oil was became much in-
 “ crufted, but not a particle of depofi-
 “ tion where it was fmeared.”

I have met alfo with bile, which was
 of its ordinary fluidity, without any
 appearance whatever of concretions,
 which evidently contained a quantity
 of the peculiar cryftallizable matter of
 which fuch concretions are formed. In
 fuch a cafe, therefore, it is probable
 that nothing but a nucleus was wanting
 to its formation, and that if accident
 had fupplied this, a concretion would
 have been found in the bladder. The
 only peculiarity of this bile was its re-
 markably deep and almoft black color,
 of which I have fpoken elfewhere, as
 connected with the exiftence of concre-
 tions, and it was this circumftance that

led me to examine it more particularly. It may be asked how the presence of this matter could be ascertained. Alcohol of a temperature under 50° was added to it, so as to coagulate the ferous part, and dissolve the separated bile. In such a temperature it will be found that it does not dissolve any of the matter of concretions. On one portion of the separated residue alcohol was boiled, which as it cooled, deposited lamellated crystals, and on another sulphuric ether, which, as it evaporated, produced the same appearance.

Biliary concretions vary considerably in their specific gravity, and this variation does not appear to be connected with any peculiarity of structure. Of two of my purest crystallized specimens one sank and the other swam in distilled water; the black and deep colored angular ones generally sank, while others, especially where they had a tendency to a crystalline appearance, usually swam. No general statement, therefore, can be given; probably it

allows of a range not much differing on either hand from the specific gravity of distilled water, for some which sank in it, swam in our New River water, which contains but a small proportion of saline matter, and therefore is very little more dense; and others which swam in distilled water sank in alcohol, or even in common rectified spirit.

Chemically speaking, there appear to be two distinct species, differing from each other in their relation to other substances; both of these are sometimes found, in a greater or less degree, contaminated by heterogeneous matters.

The crystallized and colorless concretions seem to contain one of these in a state of the greatest purity.

On bringing such near to a burning body they liquefied, and then took fire, burning like common wax, but with a thick white smoke and unpleasant animal smell.

Water did not dissolve or affect them in the least, even when its temperature was increased to boiling.

Alkohol in ordinary temperatures, that is, under 60° , dissolved very little or none, but when heated to 167° it entirely dissolved the whole of some of them. Fourcroy says, that it requires nineteen parts of alkohol for the solution of one part of this concretion. As the liquor cooled the whole, or very nearly so, of the dissolved matter precipitated; and if the change of temperature was slowly and gradually effected, it assumed the form of hexangular plates; if somewhat more rapidly, it had rather a tendency to shoot into spicular crystals. This hexangular plate may probably be considered as the natural and appropriate form of crystal of this matter; for in some concretions a plate may occasionally be found with one or two similar angles, sufficiently distinct for observation.

Sulphuric ether entirely and readily dissolved it, and the solution was per-

manent as long as the ether retained its liquid form, but as it evaporated the dissolved matter remained, and crystallizing, generally took its spicular modification of form, shooting beautifully in radii from different centres on the sides of the containing glass.

Essential oils, and particularly that of turpentine, were others of its solvents. A portion of a solution in this latter having been left exposed in a shallow glass pan for a few days of the summer, had coated it with a great number of small radiated crystalline masses, all of which were exactly circular in their outline, and all arose from their own central points.

Sulphuric muriatic and oxy-muriatic acids did not, in ordinary temperatures, affect the form, diminish the weight, or appear to have received any impregnation. In a boiling heat the sulphuric acid did more, it blackened and dissolved it, with the same apparent phenomena that it exerts upon vegetable matter; the perfect decomposition of the concretion,

the separation of its carbone, and the extrication of fulphurous acid gas.

Solutions of soda and potash did not act upon these concretions in the least, and it seems to be in the altered relation of this matter to alkalies, compared to that of the bitter principle of bile, that the great difference between them consists.

When these concretions were immersed in strong and pure nitric acid they were immediately acted upon; their aggregation was broken down, the liquor became as it were muddy, and a portion of greenish liquid oil collected upon the surface; this in time dissolved, particularly if exposed in a somewhat increased temperature, with a very copious extrication of the orange colored fumes of nitrous acid; the liquor became transparent; and had its color considerably deepened towards that of orange.

This acid solution dropped into a large proportion of distilled water, gave an immediate precipitation of white

opaque membranous films, which subsided to the bottom, and could be collected readily to the quantity of the concretion subjected to the action of the acid.

This matter, on drying, became hard and friable, and possessed scarce any perceptible bitterness of taste. Being collected to the amount of a few grains, it was tried in various ways. It was not inflammable, like the original matter, but it liquefied, grew black, and, after a red heat, had left only a very slight residuary cinder. It was immediately soluble in ether and in alcohol, and these solutions, but more especially the latter, had acquired a very striking yellowness of tinge, on the evaporation of the alcohol; before the whole of the liquor had passed over, it gave a whitish pulverulent precipitate, as the resins do.

On the addition of a small quantity of a solution, either of soda or potash, to this matter, it was immediately dissolved, and the liquor assumed a deep reddish brown color; this, when the

proportion of alkali was accurate, had also a decidedly bitter taste. An acid added to this colored solution gave a white precipitate, which more alkali again dissolved with assumption of the brown color.

The concretion, therefore, after having been submitted to the agency of nitric acid, was essentially altered in its characters, and brought into a state much more nearly resembling that matter which is in bile, combined with soda. It had become soluble in alkali, with the assumption of some bitterness of taste, and of the peculiar color of bile, in which relations to the same agent it had not previously stood. The nitric acid, too, had been deprived of a certain portion of its oxygen, for its previously white fumes were then converted into orange ones. Independent of this alteration of the acid, the analogy of other phænomena would lead us to the belief that the matter had received a larger portion of this particular principle. The tendency of every sub-

stance to combine with alkalies seems to increase in proportion to the quantity of oxygen with which they are combined. In the bleaching of linen, for instance, this combination is effected before alkalies can act upon or dissolve the coloring particles, as the use of the oxy-muriatic acid, and the effects it produces, have most decisively established.

But even if the fixation of oxygen be admitted, it may be asked, whether this be all the change which takes place, and whether the base remains unaltered, except in this one particular? If this was all, it seemed probable that the oxygenation of this species of biliary concretion ought also to be effected by other, and perhaps by more simple and satisfactory methods, as by the use of oxy-muriatic acid, or its combinations; and this idea would also perhaps be favored by considering that the original matter is inflammable, and the altered matter not so.

With this view I nearly filled a small bottle with oxy-muriatic acid, and added thereto a few grains of this concretion; in order to assist the decomposition of this acid I exposed it to a strong light, which is found, under other circumstances, to be strikingly favorable to the transfer of its oxygen, and continued the exposure for three days, the acid was altered, it had lost its superabundance of oxygen, and had become common muriatic acid; but this liberated oxygen did not appear to have combined with the matter of the concretion, which was not more soluble in alkali than before, or altered at all in its relation to ether, alcohol, or other solvents of it.

As a difference of temperature might considerably influence the affinities of these several principles, I triturated a small portion of this concretion, so as to mix it intimately with oxy-muriat of potash, and then having added a small quantity of water exposed the mixture to 212° , for a considerable time with-

out apparently effecting this alteration. Another portion of the same mixture was left exposed to light for several weeks, but this transfer of oxygen had not taken place.

It was farther desirable, upon the same principle, to try the converse of the former experiments, to endeavour to deprive bile of its oxygen, and see whether it was by this means changed into a matter resembling its concretions. For this purpose I mixed bile with water, impregnated with hydro-sulphure, under various circumstances and temperatures, but without success. There was, after long standing, some precipitation of thin films, but it did not seem to be analogous to the matter of concretions.

Upon the whole, therefore, there are many reasons why we should be cautious in admitting the conclusion that the difference between biliary concretion and matter of bile depends solely upon the relatively increased proportion of oxygen in the latter. If other ani-

mal matter did not stand to nitric acid in a very similar relation, if other less suspicious modes of adding oxygen produced the same effect, or if its abstraction left any thing like concretion, the theory would be perfect; as it stands here it is very deficient, but still it corresponds so well with various strong analogies, and so strikingly explains all that we know of its production and cure, that though I may be condemned for the adoption of a hasty and unfounded opinion, I cannot help pressing it as a point still deserving future consideration.

Some writers have been led, by the similarity of external appearances, to suppose that this matter resembled spermaceti in its properties. From the previous notices of the relations of the matter of concretions to some few substances, the comparison between it and spermaceti, with respect to these relations, was easy, and in consequence of the existing affirmation it was also of consequence*.

* *Annals de Chymie*, Vol. VII. p. 189.

Fourcroy has remarked that they differ with respect to the temperature, at which they assume a liquid form, and states that spermaceti fuses in a heat from 105° to 112° , whilst biliary concretions remain solid at 235° . Each of these substances was submitted to the action of sulphuric ether, the biliary concretion was dissolved, and the spermaceti remained for a day longer, under the same circumstances, apparently unaltered. Alcohol also, when assisted by heat, effected the solution of both, and both crystallized in radii on the sides of the containing vessel as it cooled; but a given quantity of this menstruum would not dissolve above one eighth the quantity of spermaceti that it did of concretion. As alkalies had not touched the matter of these concretions, an equal portion of it and of spermaceti were exposed in a solution of potash, and the bottles were each placed in a slight sand heat, the latter not only melted, but remained diffused through the liquor in the form

of soap, while the former preserved its solid form unaltered. Spermaceti, too, was differently affected by the same nitric acid; it entirely melted, and formed a stratum of oily matter, which floated upon the surface; on being poured into water this oil concreted, but it still preserved its original relations; it had not become more soluble in alkalies, like the matter of biliary concretions, but remained spermaceti still under every circumstance.

Nor did the concretion more accurately resemble any of the other animal fats, but seemed to be a peculiar and distinct matter, which the organization of the liver does in some instances produce instead of its natural and healthy secretion.

Another species of biliary concretion, which there is ground to consider as a perfectly distinct one, is the black and greenish black sort; these were either amorphous or lamellated, without the least appearance of radiated or plated crystallization.

They were remarkably friable, felt gritty in the mouth, and had no perceptible bitterness or other peculiarity of taste.

They did not inflame, and almost generally sank in water, which was noted both by Bianchi and Morgagni.

Alkohol or water*, even when boiling, acquired no impregnation, and were not altered in their color.

Ether assumed a deep green color, but even after a digestion of many days with repeated additions, the concretion still seemed to retain its original state and color.

The colored ethereal solution yielded no crystals on evaporation, but an extractive mass which accurately resembled bile.

* I dare not venture, however, to affirm that this is universally or even generally the fact, or whether it may ever be so at the time these concretions are taken from the bladder, and before they are dried and have undergone a long exposure to the air. Hoffman describes some—*qui ingentis fuere magnitudinis & mollioris substantiæ, totam fere cystidis implentes cavitatem, ultra dimidium in aqua calida fuisse solutos.* *Med. Rat.* T. IV. Sect. ii. Cap. 2. Sect. vi.—Bartholin also, Cent. iii. Ep. Med. 85.

The residuary skeleton of these concretions appeared to be pure carbone in every other respect, and on being exposed in a jar of oxygen gas inverted over mercury, to the focus of a burning lens, it was, with the exception of a slight film, converted into carbonic acid gas.

Alkalies dissolved a considerable portion of these concretions, and formed a deep brown colored liquor, which, when diluted, had a green tinge.

Nitric acid, assisted by heat, dissolved them readily, and gave a bright reddish brown solution resembling that of bile.

The ashes of a small portion of this concretion, which had been burnt in the focus of a burning lens, had a little water added to them and received an alkaline impregnation, which was evident from the alteration of paper tinged by the blue color of violets.

In many respects, therefore, this species of concretion gave proofs of its containing actual bile, but they are not

composed of dried bile alone, for the bare artificial exsiccation of this fluid, however long continued and in a greater heat than it is ever exposed to in the body, cannot bring it into a state at all similar to this, or even render it insoluble in water; the diseased change is therefore different in its nature, and mixed with the matter of bile, there appears to be a great but variable proportion of carbone, upon which the peculiarities of these concretions depend *.

Independent of the presence of carbone, the bile itself seems to have here also undergone a change from its natural state beyond what simple inspissation can produce, and we have in the same bladder the several gradations of

* Piccolhominus thought, from their appearance, that they were formed from bile which was burnt in the cyst like a coal.—*Bilis in ea diutius quavis de causa commorata exurit, & carbonis instar in calculos subnigros convertitur. Anat. Prælect. xx. p. 129.*

Galen describes a modification of bile which very accurately resembles the appearance of these stones.—Ο εξ υπερπλησεως της ξανθης χολης γινομενος, ον τινα και ασφαλτωνδη ονομαζομεν δια το σιλβειν αυτον ασφαλτον δικην. *De finit. δ.*

natural bile, altered bile as it enters into the composition of the concretion, and carbone. May it be inferred from hence that the natural bile does in some way or other undergo this alteration in the bladder, independent of the state in which it is secreted; and what are the circumstances determining it? This kind of concretion, differing as it does from the former, has not hitherto been sufficiently noted or connected with the appearances during life to allow of any reasoning on the causes of its formation.

This concretion then, though it contains a peculiar matter, widely differing from the former, does not contain it in a state of purity, and is therefore rather to be considered as a mixed one, and with the small portions I have obtained, the same has uniformly been the case.

The varieties, therefore, which require to be mentioned relate to the admixtures which are occasionally found with the former species, and these seem

to be bile and animal matter in various proportions.

Of the concretions which contain the crystallizable matter, those only can be said to contain it pure which are perfectly colorless, and this is by no means their common appearance; they are for the most part of a brown color, and sometimes, where they are formed of distinct layers, it is deeper in some than in others of them. This appearance I consider as adventitious, and as drawn most probably from the coloring matter which the particles carry mechanically along with them at the time of the formation of the concretion from the dense and brown medium in which they shoot. This appeared on exposing them to solution of potash, and in some cases, especially where they are recently taken from the bladder to hot water, which extracted and combined with their coloring matter, whilst upon that which is the basis of the concretion it had no action, but which remained freed from color, and perfectly whitened; on

farther examination this separated matter was found to resemble bile very accurately.

Another heterogeneous substance, which constitutes a part of many biliary concretions, is animal matter, resembling in every respect dried mucus; this constituted the variable quantity of residue which was left on digesting them in ether, which dissolved both the matter of the concretion and its coloring impurity. It seemed more particularly to adhere to and form a coat upon the surface, for, on exposing a perfect concretion to the action of ether, I have often seen the whole dissolved, except a film, which, though thin, still retained the original form of the mass*.

The chief circumstance which seems to determine the formation of biliary concretions is a life of indolence and inactivity; it matters not whether it has

* The explanations attached to the plates, will sufficiently explain their application to what has been here advanced.

been passed amidst the luxuries of greatness, or the hardships of poverty ; and if it be more common in the former, it is perhaps because necessity compels the subjects of the latter to more personal exertion. This appears to be a point of universal consent. They are comparatively much more frequent in women than in men, and in either sex, especially in those who have passed the middle and active period of life. Haller noticed the frequency of their occurrence in criminals, whose death had been preceded by long confinement *. They are often found in the gall bladders of oxen, which have been stalled during the winter months, and I have reason to believe that they occur in a larger than common proportion of maniacs who have been long confined.

* Opusc. patholog.

* Bianchi remarks the frequency of their occurrence in those who have been subject to frequent attacks of gout, and thinks the combination so common that he adds, *Adco verum est non minorem intercedere consensum inter renales calculos & hepaticos quam inter eandem lithiasum & podagram.* *Hist. hep.* T. I. p. 193.

What then are the particular circumstances of such a mode of life, and how can they be supposed to operate in the formation of biliary concretions? It implies not only a want of exertion of the muscular powers, which are obedient to the will, but also less action of the involuntary ones. The contractions of the heart and arteries are made more slowly, while exercise may increase them so as to be almost countless. The respiration is much less frequent, and a less proportion of oxygen gas is expended by an animal in a state of quietude. The relative situation of the liver to the diaphragm, and its participation in the motions of it during respiration, is another circumstance also by which it is very probable that its secretions are affected. From the experiments upon these concretions with nitric acid, I would again repeat that no conclusions can fairly be drawn as to any morbid alteration which takes place in an animal body, but if it can be supposed to act simply by supplying

oxygen to its decomposition to the matter of concretions, and thus to bring it nearer to that which is combined with alkali to form bile; it may be asked whether the deficiency of oxygen in the system may not perchance occasion the secretion of a matter containing less, and which crystallizes instead of a matter containing more, and which is, by this means, rendered soluble in alkali.

It is probable that climate, and its attendant circumstances, have a considerable influence upon this morbid alteration. As far as I have been able to ascertain, it must be a very rare disease indeed in hot countries, though the inactivity connected with them might seem, at first sight, likely to render it frequent. The bile there has a tendency to run into a different state of alteration. The antients appear to have known little of it, with us it is extremely common; Haller mentions it as remarkably so in some parts of Germany*, and as far as can be judged

* *Opuscula pathologica.*

from the number of cases recorded, it must likewise be frequent in France; but there does not, upon the whole, appear to be sufficient foundation for any general opinion upon this point at present.

Another, and sometimes a very formidable morbid alteration of bile, often occurs, in which *it is secreted in much greater abundance, more aqueous, and certainly, too, exerting more violent effects*, than any quantity of natural bile would do. It is to be regretted that we have no chemical examination of bile, which has occasioned the consequences alluded to, on record, and that our knowledge of animal chemistry is probably too imperfect, even if we had, to discover and to indicate the change which has taken place; as it is we know it only by its effects, and as producing the disease called *Cholera*, and some less intense varieties of it in many *Diarrhæas*.

Cholera is among the most sudden and violent of all diseases in its attack;

it is rapid in its progress, and often fatal in its effects. It sometimes commences at once, with its characteristic symptoms, an immense vomiting of bilious matter rendered ropy by admixture of mucus, under which form it continues, and a frequent discharge by stool of a similar matter, attended with pain and tension of the whole intestinal canal. There is great anxiety, with heat and thirst, but after a short continuance the smallness and frequency of the pulse, the coldness of the extremities, the pale hue of the countenance, its clammy suffusion, and the spasms, which first attack the calves of the legs, and then become gradually general, threaten the near approach of death; this sometimes does happen in a few hours, but where it does not, the disease rarely lasts more than three or at most four days. It is scarcely possible to conceive, without seeing, the vast difference which a few hours continuance produces in those who, at the

beginning of that period, were in the full enjoyment of health and vigor.

The acrimony, and what has ever been called the corrofive power of the matter thrown up, has been noticed by authors, and its color has been mentioned as yellow, green, or black *.

The especial cause producing this unusual action of the liver is the exposure to high temperatures ; hence it becomes an endemic in hot countries, where it attacks in all its violence, but with us it is rarely found, except when a hot summer has produced an approximation of our temperature to that of more southern climes.

It is, therefore, from such situations in which the morbid varieties of bile, connected with increased flow, are found in full perfection and abundance, that we must expect a satisfactory examination of their qualities. It is rather remarkable that I have not been able, through the whole of the last summer,

* Hoffman Med. Rat. Sect. ii. cap. 8.

to obtain the bile of any patient who had clearly fallen a victim to it.

Heat will, even when artificially applied, considerably affect the secretion of bile. It has not unfrequently been purposely employed upon myself, and has uniformly produced its effect, but the matter brought up has been yellow in its color, and has had the common taste of natural bile.

Habit, too, has considerable influence over the secretion of the liver, and when a hot climate has occasioned a few attacks of increase in its quantity, it will readily be excited afterwards even by less causes. On the inhabitants of the East and West Indies resident here, I have noticed more frequent derangement from this source than in the natives, and that in temperatures much less than they have been accustomed to, and which seems only explicable under this idea. Bilious diseases, as they are properly termed, are one great bane of all who have passed their lives in warm climates, and I

believe they are less frequently attended by organic disease than is commonly imagined.

The lesser attacks of this affection, which seem only to differ in degree from the higher, constitute a very common class of autumnal complaints in this country. They may be properly called *bilious Diarrhœas*, as proceeding certainly from the state of the biliary secretion, and being attended with the same abdominal pains, the same depression of strength, but not with the tendency to vomit, which makes cholera so much more formidable.

In ascertaining the various causes of diarrhœa, much information, and, in many instances, much practical advantage, may be drawn from the appearance of the stools. They may, for instance, when bile is the cause, put on the several shades of color which we know this secretion to be able to assume. Of the causes of these shades we know somewhat, and this knowledge may modify the remedies to be employed; so too the

clay colored stools of jaundice add assurance to other symptoms; the greasy dejections which constitute colliquative diarrhoea; the mucous and bloody ones of dysentery; and those which contain pus, and are consequent to the rupture of an abscess in the canal; are all of them striking characteristics of their several diseases, and amply repay the inconveniences of their examination.

THE bile contained in the bladder is sometimes found to be much *more aqueous, less tenacious, less colored, and less bitter*, than natural; upon this change I know not that any particular symptoms or inconvenience depend. It is generally connected with diseases of debility, where the circulation is languid, and all the secretions are imperfectly formed, such for instance as chlorosis*.

* De Graaf mentions bile entirely serous, and tinged with so slight a yellowness that linen immersed in it scarcely received any color therefrom. Obs. 10.

Van Swieten Comment. in Boerhaave, Sect. 935.

WHEN from impaction of a concretion, or any other cause, such as schirrus in a particular local situation, each of which instances have occurred to myself, the passage of the bile from the liver into the gall bladder is prevented, this receptacle is not in general found empty, but *distended* to about its usual size, or something more, *by a thick colorless mucous fluid*, which is commonly coagulable into a firm mass by heat, by acids, and by alkohol; and except that the coagulum seems denser, it very accurately resembles serum. This fluid is purer from any tint or admixture of bile, in proportion as the obstruction has existed longer, and it should appear that it is to be considered as the appropriate and unmixed secretion of the internal surface of the gall bladder*. But I once saw a re-

* Ad ignem coagulabatur instar albuminis ovi. *Van Swieten Comm. Sect. 950.*

This appearance is by no means uncommon, various authors have described it, and especially Glisson, *Anat. Hepat. cap. 39*, who found contained in the gall bladder

markable deviation in this liquor from what I thought to be its uniform characters, though as I did not at the time suspect the difference, I neglected keeping more than about half an ounce of the contents, which amounted in the whole to a full three ounces. It had about the usual color of serum, with a very slight sweetness of taste, without any bitterness; it felt tenacious between the fingers; it seemed to alter the color of delicate vegetable blues more than the admixture of its own yellow color alone would have done; neither heat, nor alcohol, nor acids, nor matter of tan, produced the least turbidity or alteration in it. This, therefore, did not answer to the characters of serum or of jelly, and what was it? probably an admixture of mucus with water, which appears best to answer to the description I have given. This, therefore, may, I think, be considered as a

humorem serosum pallidiusculum, minime amarescentem, sed insipidum potius dulcique proximum.

secretion altered from its usual state, and therefore a disease, though not in itself of much importance under any point of view.

Opposed to the more aqueous state of the bile it can, I think, in certain cases be proved that *a matter is secreted* by the vessels of the liver of *a much greater density* than is natural, still retaining the yellowness of bile, and by its accumulation giving the general yellow color which is frequently found in diseased livers. The deposition of this altered matter is generally also attended by the secretion of a certain quantity of common bile, for I have never seen it where the gall bladder was not as full as natural, and the contents of the intestines of a natural color. No mechanical obstruction then to the free passage of the bile exists in this instance, nor has any been found in the larger ducts, or at their entrance into the duodenum, yet jaundice is its usual concomitant. Of this matter, too, it does not appear that any portion en-

ters into the biliary ducts themselves, or does more than accumulate in the liver. On what then does the jaundice in this case depend? apparently not upon the absorption of the bile itself, but more probably upon that of this diseased yellow matter, which, on account of its deviation from a fluid state, the biliary ducts cannot convey away. What are the peculiarities of this matter I know not, or whether it approaches at all to the nature of concretions, but it has seemed to me to be a disease very often connected with the internal use of the several modifications of alcohol.

It is impossible to mention this pernicious and general custom without noticing how large a proportion of modern diseases, and these the most fatal, is fairly attributable to it; and lamenting the policy which, by tolerating its preparation, sacrifices the health and morals of the people to the revenues of the state. The abundant follies and luxuries of life are fair and proper objects

of taxation, and a good citizen will offer up a share even of his necessaries for the safety and existence of a government he cherishes, without repining; but the vices of mankind require actual punishment to repress them effectually, and it is very difficult to perceive the justice of a decree which throws a man's bones with ignominy into the highway for taking a small portion of arsenic, and permits another to pass peaceably and with credit to his grave, who has wilfully swallowed enormous quantities of a poison, slower indeed in its operation, but no less certain in its effects.

There is also a state of the bile which appears to depend upon a vitiated secretion, and which constituted the principal modification of the *atrabilis*, described by the ancients, and was by them well described, and by no means confounded with evacuations discolored by blood.

Of its existence I am sure, though, from the fæcal matter with which it

subsists in the stools, I have had no opportunity of endeavoring to ascertain in what the alteration depends. The stools have a deep black color, with a soft consistence, and greasy sort of appearance. These are connected with great torpor in the functions of all the abdominal viscera, and amongst the rest with costiveness. There is, too, a close relation between these altered fæces and biliary concretions, perhaps both depend upon some modification of the same disease. Those in whom I have met with this appearance have often passed their stools white and clayey, and have been subject to occasional attacks of jaundice, attended with considerable pain.

FROM the effect of various acids upon bile out of the body, in producing a green color of it, and from the similar appearance which is often found in the fæces, we are led to suppose that the same cause produces the effect in either instance; I have added the gas-

tric acid to yellow bile, with a view to these effects, and have found the green muddy color, and flocculent precipitation of the ferous part, to follow in the same way as when other acids were used.

This then is to be considered as a morbid alteration produced in the bile, by the application of an extraneous matter, after it has left its secreting organ, and nurses are well aware of the several appearances connected with it, from observing the stools of young children.

Among the diseases of this secretion we may reckon the *presence of blood in the biliary canals*, which dissections have occasionally ascertained to be the fact *. This is one source of hæmatemesis, and in hard drinkers not an uncommon one. Morgagni mentions an hæmorrhage from the internal substance of the liver through the biliary ducts into the intestinal canal, and occasioning a copious

* Portal Memoires de l'Academie, p. 160.

discharge of blood both from the stomach and intestines. I am acquainted with one instance where this seemed to be the case. From previous habits an affection of the liver had been long suspected, and after some duration of uneasiness in the right hypochondrium an attack of nausea, with shivering and fainting, was followed by a discharge of a large cake of blood from the stomach, and the subsequent stools were deeply colored by blood also; this was but a single attack, nor was there afterwards any reason to suspect such an affection of the stomach as the discharge of such a quantity of blood from its coats would have produced; and in this case it was attended by much temporary relief in the state of general health.

LASTLY, there remain for consideration *the several modes of treatment* proper to be adopted in the diseases which have been mentioned. Into these I shall not attempt to enter minutely, but rather state those general

principles which my own experience has impressed upon my mind.

Of jaundice the treatment will be as various as its causes, and will consist in the removal of the obstructing power, whatever it may chance to be. The nature of this then is a first and most essential point for investigation.

When the symptoms favor the supposition that the jaundice arises from the impaction of a biliary concretion in the duct, our endeavors are to be directed to facilitate its passage into the intestinal canal. This is best done by the use of those means in the first place which are known to abate increased action of muscular fibres; and in the next of such as destroy irritability, in which way the existing contraction may be overcome, and the susceptibility of the duct to the extraneous body be diminished. It is only in the more violent cases that any active practice becomes necessary under the first of these indications, but such are by no means unfrequent, and in them I am

ture that venesection is of essential service; it should be performed once in rather a large quantity and no more, for in the relaxation of muscular contraction and diminution of increased action the effect will be not in proportion to the quantity lost upon the whole, but to the celerity with which that quantity is taken away, and twenty ounces of blood lost at once will be much more efficacious than forty taken at repeated times, even though the intervals be but short between each.

Immerfion in a warm bath is a practice commonly employed upon a fimilar principle, but I have noticed that its temperature is in general undefined, and the length of its continuance not fufficiently enforced. In order to produce the moft powerful relaxant effects its temperature fhould be from 100° to 110° , and certainly not lefs than the lower of thefe degrees; and the immerfion fhould be continued till an incipient faintnefs is produced, which, whether it take place after a longer or a

shorter time, is the best criterion to regulate its duration, for where it has not followed, the bath has not seemed to me to have any good effect. This may be repeated according to the violence of the symptoms, and the feelings of the patient will, while the fit continues, lead his own wishes to a repetition. I shall here once for all speak of the utility of warm bathing in various diseases of the liver, either induced by alcohol, or residence in hot climates; in both of these cases the frequent use of it has been commonly recommended, and it has appeared to me to be serviceable, but here the temperature should be under 100° , or even nearer to 90° , so as to give the sensation of what is called luke warmth, and it should never be continued so long as to occasion faintness. I think, too, in such cases that sea water has infinite advantage over common water; and as I know, from experiment, that saline impregnations are absorbed into the system, and that sufficient portions to be rendered sen-

sible pass out of the body by the kidneys, I would hazard a suggestion that nitre more especially, and in some cases other salts, might be advantageously employed in this way; at present I confess that we have no certain data with respect to medicated baths, but to me it seems a subject well deserving of patient and accurate investigation. The only object at present looked to is temperature, and people are in the constant habit of travelling very many miles for the purpose of getting water at 118° at Bath, 80° at Buxton, or 70° at Matlock, without reflecting that hot water is the same whether it be drawn from the bowels of the earth or the spout of a tea kettle, and that as far as analysis has gone there is no peculiarity in the matter impregnating any of these waters which can give them a just title to pre-eminence. If experience be required in support of this opinion, I will quote that of the accurate Dr. Saunders*,

* Treatise on the Liver.

upon which foundation he states that the waters of Bath, Bristol, and Buxton, have no powers superior to those of common pump water, heated to the same temperature, and I can give it the confirmation of some cases which have fallen under my own notice.

The exhibition of opium, chiefly in its solid form, is often combined with the former relaxant remedies most advantageously, inasmuch as it allays the distressing violence of pain, and its use is not prohibited by any inflammatory symptoms. When it is to be employed it is not sufficient to administer small or even ordinary doses, which are too little to produce any definite effect, but rather to give a large one in the first instance, and to follow this up by the repetition of smaller at certain intervals, which will prolong the powers of the medicine, and sometimes the concretion will pass while the patient is under its influence.

Repeated emetics, and especially ipecacuanha, have been recommended as

assisting the passage of the concretion, and shortening the complaint. It is moreover stated, on the highest practical authority*, that it may be given under the severest intensity of pain, which it will tend rather to allay than to aggravate. Now it happens that not only nausea but actual vomiting are commonly among the most distressing symptoms we have to combat, and that it is unnecessary to excite them artificially farther than as it may be thought adviseable to second medically the process for their expulsion, which nature herself establishes. But without entering into the theory of their use, I think when they have been given that the duration of the disease has not been shortened, or any single symptom alleviated in its violence. It is true that my recollection does not furnish me with any instance of injury produced by them, but I have always thought them suspicious, and that any propul-

* Heberden, Med. Transf. Vol. II. p. 160.

sion of the concretion by mechanical pressure, which is all that in the first instance they can effect, was rather to be avoided than promoted, and that it was better to depend upon those methods which rather tended to dispose the ducts to relaxation, and in this way to favor its passage.

The instantaneous relief which follows the entrance of the concretion into the duodenum marks most decidedly when that takes place. It may be doubted whether any farther aid be necessary, perhaps it is not positively so, but it seems advantageous to preserve an open state of the bowels by means of mild purgatives, such as oil and manna, for some days, not only for the purpose of carrying the concretion out of the body, but also, by the discharge they occasion, to assist as much as we can the change and renewal of the aqueous fluids contained in the vessels, and the consequent removal of the bile which they hold in solution.

It is of much importance, in the next place, to consider how far we may be able to prevent the future recurrence of these attacks, which is always to be suspected, and whether it be possible to effect the solution of these concretions when they are contained within the gall bladder. These are points which do not admit of absolute demonstration, and which one would perhaps be rather disposed to deny; but with respect to the powers of medicines this reasoning is not justifiable, and it is better to use any means, that are recommended upon tolerable authority, than to leave a patient to suffer without endeavoring to assist him, or to give up the chance of success because the usual methods fail.

Various medicines have not only been proposed, but confirmed by the reported experience of some, which act as solvents upon the more common concretions out of the body; of these ether and oil of turpentine are the chief, and the combination of them was first

employed in France*, and its effects spoken of in high terms. Alkohol and some essential oils have been referred to as eminently useful, by a practitioner of our own country †. Of the powers

* This combination is said to have been used successfully, and in unequivocal cases, by some French writers; some of their testimonies may be found in the collection of the Academie de Medecine, Vol. I. p. 288; and the following general observations on its theory and mode of administration are from the *Elemens de Chymie*, published at Dijon, in 1773, Vol. III. p. 322.

La volatilité de l'éther ne permettant pas d'espérer qu'on pût le faire parvenir seul jusqu'à ces concrétions, il falloit trouver encore une autre substance qui s'unit à lui, de manière à le rendre un peu plus fixe, sans enchaîner son action; nous avons reconnu que l'huile essentielle de térébenthine remplissoit parfaitement ces vues; le mélange de ces deux fluides, à parties égales, dissout même à froid, tous les calculs du foie, il ne laisse que la petite portion de terre calcaire qui entroit dans leur composition & qui, une fois désassemblée, peut aisément s'échapper par les conduits de la bile, les heureux effets en ont déjà été constatés par plusieurs observations.—On le prend tous les matins à la dose d'une cuillerée à café, il est d'une saveur rebutante mais on peut le rendre moins désagréable, en y ajoutant quelques gouttes d'une autre huile essentielle. Deux malades qui ont fait usage de ce remède, ont rendu par le bas de la terre calcaire, qui formoit la base des concrétions, & même des calculs qui avoient probablement assez perdu de leur volume par la dissolution pour passer sans irriter les conduits.

† Dr. White, of York, says that he has used solutions of essential oils in alkohol, with great success; he seems,

of these I know nothing from experience, but a priori it may be justly questioned whether a sufficient portion of that small quantity, which is taken by the mouth, can ever reach the gall bladder, through the mazes of the circulation. If, however, the generally received statement be true, that the biliary concretions of stalled oxen, which are generated during their confinement of the winter, disappear in the summer, when they have the enjoyment of fresh pasture and exercise in the open air, it is to be inferred that some of these altered circumstances are sufficient to effect their removal even when they have been in actual existence. Practitioners, who have thought that the whole difference depended upon the

however, to wish to keep the particulars of his practice secret, for he only mentions the fact generally. *Essay on Diseases of the Bile, &c.* Second Edit. 1777.

One would almost think that Hippocrates had ascertained the utility of a similar practice from experience, when he mentions a species of jaundice which is to be treated οἶνω οἰνωδεῖ καὶ ἀσπα εὐθρότερον ποιεῖ τον ἀνδρωπον τετοιον. *De Locis.*

alteration of their food, have endeavored to imitate it by giving largely of the fresh juice of grafs*, &c. and, according to their reports, with the greatest advantage. But it should likewise be remembered that among these altered circumstances muscular exercise in the open air is to be ranked, which, if we look to the habits of those who are most especially disposed to this disease, is not to be passed over lightly. On such exercise, and especially riding on horseback, I have always laid parti-

* Videntur Glissonii observata evincere quod hyemali tempore in bobus natæ incrustationes calcu'osæ vasorum, solvuntur denuo dum verno tempore recens gramen pascentur armenta.

Ante multos annos hominem curavi ab hoc morbo qui quotidiano labore sibi & suis victum parare coactus expensis remediorum impar erat: simul tamen constantis animi & recuperandæ salutis avidissimus: hinc promittens curationem facile persuasi illi 'ut solo gramine viveret. Decoquebat magnam quantitatem graminis in aqua pura, & decocto melle edulcorato, utebatur pro potu communi; tenerum gramen verno tempore pullulans, vel & post primam sectionem renascens, incoquebat carniû jusculo, illoque solo fere utebatur cibo — Sanatus autem fuit a pertinacissimo ictero sola hac methodo, & vidi illum pluribus annis postea incolumi sanitate frui. *Van Swieten Comment. Sect. 950.*

cular strefs, and I believe it has been useful. On the recommendation of diluted nitric acid, as an internal remedy in some diseases of the liver, I was induced to embrace an opportunity of using it in a patient who was subject to frequent attacks of jaundice from biliary concretions; he has improved in his health, and remained free from the complaint from the time of his using it, which he has now done pretty steadily, in the proportion of one drachm to a pint of distilled water daily, for about eight months; from this case as a single, and that an equivocal one, no inference can fairly be drawn, but the administration of acids in certain cases of jaundice is by no means a new practice, and the report of Baglivi may strengthen the probability of their being useful.

The jaundice which attends occasionally upon spasmodic affections is not for the most part of long continuance,

* Acidulas in Ictero a pluribus laudatas vidi authoribus.
Baglivi Prax. Med. Lib. I. Cap. 9.

the cause of obstruction soon ceases to act, and it is enough that remedies, suited to prevent the recurrence of the original disease, be employed without attending to this particular symptom.

Among the causes of this derangement of the course of the bile, I have ventured to rank general fullness of the vessels of the liver from whatever cause arising. If it attend hepatitis relief must be sought from blood letting, no other method can remove it; probably the same means would produce the same relief where it accompanies phthisis, if it could be justifiable to employ a practice for removing a symptom which would ultimately increase the original disease, and this has always seemed to me to have been unequivocally the case where bleeding had been used in the more advanced stages of phthisis.

In that state of the liver which produces jaundice towards the end of our intermittent fevers, mercury is the best and only remedy. Calomel in small

doses is the form under which it is commonly employed with us, and it seems, in this and some other hepatic diseases, to act most powerfully. In intermittents of long standing, and which can be ascertained by examination to be connected with this affection of the liver, though not in such a degree as to produce jaundice, I have often seen the bark alone compleatly inert, and when it has afterwards been combined with calomel the disease has readily yielded.

Where schirrus of the substance of the liver, or neighbouring parts, operates mechanically by its pressure upon the ducts, and occasions jaundice, it is more likely to prove the source of permanent mischief than any other cause, as our means of relieving it are less effectual. In the true tubercle of the liver, which begins with induration, and afterwards passes from thence to ulceration, the efficacy of any medicine is very doubtful; even mercurials, when given in large quantities, and under any

form, have not seemed to me to produce any decided or permanent advantage: sometimes this disease is connected with the use of alkohol, but it is not the necessary or indeed common consequence of it.

If it be admitted that torpor of the intestinal canal, and accumulation of mucus in the duodenum can obstruct the departure of the bile, and thus occasion jaundice, as it seems to do in young children, the employment of any certain and active purgative will be sufficient to remove it; calomel and jalap are those which are especially suited to this indication, and the former may be given in very large doses without inconvenience, indeed such are generally necessary. It is well also to persevere after its action in the use of small quantities of rhubarb, mixed with spice, and sometimes the occasional repetition of the purgative is proper. If I could not succeed by any common means in exciting the intestines into action I would have recourse to electri-

city, which I have sometimes seen serviceable in this way, and especially so in one instance where small electrical shocks through the abdomen of a child produced motions when its life had been previously despaired of.

I have mentioned a peculiar state of liver which I have thought especially connected with dram drinking, where the secretion itself seemed to be vitiated, and especially so with respect to its density. In this our means of relief are more certain, and the operation of medicines more ascertained. I think that mercurials are here injurious, and ought never to be given; but in the earlier stages of the complaint the diseased action in which it consists may be stopped by the steady and regular use of bitter and warm purgatives, a mixture of the infusion of gentian with that of fenna answers this purpose better than any other which I have seen. In the more advanced stages I think, too, the nitric acid will be found as useful as mercury is inju-

rious; at present I have in my own mind experience enough to justify me in recommending it to notice, though not sufficient to enable me to speak with precision as to its powers. In conjunction with these means a perfect restriction from the use of alkohol, with great regularity as to modes of life in every respect, are to be strictly enjoined; perhaps the first of these points is rather to be wished than expected. I have seen very many of the evils arising from this source; I have witnessed the bodily suffering, and mental horrors which flow from it; but I never yet saw the man who had once established himself as a drunkard possess sufficient resolution to forbear the practice.

In the discoloration of the fæces, which resembles the *Atrabilis* of the ancients, which I have considered as strikingly connected with biliary concretions, and in the cases to which I allude, is attended with great torpor of the intestinal canal, the occasional use of rhubarb, with spice and

grateful bitters, so as to keep the bowels regular, is of much advantage. Exercise, especially on horseback, is also of importance; and I believe, too, that the nitric acid may be here employed with some probability of success.

It may, perhaps, require some apology on the score of precipitation, that I have thrice mentioned, and perhaps more strongly than I ought, a remedy of such late introduction as nitric acid, particularly as it has not, as far as I have seen, fulfilled the character given it by its first introducers, as an effectual substitute for mercury in the cure of the venereal disease; in many other instances I have found it a useful medicine, and of such I have spoken, wishing it however to be understood that I acknowledge the insufficiency of my own present experience for establishing its character.

In jaundice generally it has been thought worth while to endeavor to obviate the inconveniences arising from the absence of bile from the intestines,

by the administration of bitters of various sorts, which might act as substitutes for it. That in jaundice the functions of the stomach and intestines are deranged is most true, and also that bitters do strengthen and improve their powers, and in this way do good; but it remains to be proved whether they do more than this, and whether they can perform the office of bile in any way: they certainly do not relieve those general symptoms of depression, and other inconveniences which rather seem to depend upon the presence of bile in the blood than its absence from the intestines. Under the same impression that bile was necessary in the intestinal canal, some practitioners have recommended the use of inspissated ox bile in cases of jaundice. I have given it very frequently without the least manifest advantage, as far as twenty grains of the extract thrice a day, which must have been an ample substitute as to quantity for the natural bile.

The *enlargement* of the gall bladder from accumulation of bile in it does, as I have said, appear to depend upon a disease of its coats analogous to paralysis. The French surgeons* have occasionally succeeded in forcing the bile thus contained into the intestines, by pressure applied externally; this, however, is by no means a common case, though some authors seem often to have met with it: if its existence in any case was ascertained, it is probable that the passage of small electric shocks would be attended with advantage.

In the treatment of *Cholera* the mildest practice has uniformly appeared to be the most successful. It is certainly useful, in the first instance, to employ means to clear the stomach of its immediate contents, but no more violent emetic than common water, a little warmed, can be given with safety: there is sufficient irritability in the stomach and bowels to occasion action of them

* Memoires de Chirurgie, Vol. II.

on the application of the mildest substances; hence the more violent ones are at best useless, and they do not even seem to possess this negative merit, but to do actual injury by increasing that tendency to action which already subsists too strongly. After this has been effected opium is to be given in small doses, till the stomach and bowels have returned from its influence to a state of quiet, but in this tendency to derangement in them even opium itself is often rejected, and it is, therefore, well to endeavor to obviate this inconvenience by giving it in the smallest possible bulk, as in pills of half a grain each, and repeating these after short intervals, rather than in a liquid form, and even where these precautions have failed, I have sometimes effected the retention both of it and small portions of nourishment, by giving them while the patient was immersed in a warm bath.

In the *milder modifications of this disease*, which form one class of the pre-

vailing autumnal complaints in this country, opium is the remedy upon which we chiefly rely; it is proper, however, in these cases, previous to its exhibition, to give some gentle purgative: rhubarb with aromatics best answers this purpose, and the opium is afterwards combined advantageously with mild astringents.

When the immediate violence of these attacks is checked it is necessary to employ some means to remove their consequent debility, and to strengthen the intestines, especially so as to prevent a return of the complaint. The bitters have all been used for this purpose, but of late years colombo has been received into practice, as being more particularly adapted to bilious discharges than any of the others. The tincture is the best form under which it can be given, and I am much in the habit of adding it to a strong infusion of Simarouba, which I consider as the best tonic we possess in a weakened state of the bowels. To this general plan the occa-

sional administration of small doses of rhubarb may be added with advantage, and the use of Seltzer water, either natural or artificial, as a common beverage; than this latter nothing is more grateful to an irritable stomach.

In this country, too, we have the satisfaction to find that such methods of treatment are successful in removing these most depressing of all diseases, whilst in warmer climes the rapidity of their progress very commonly baffles all the efforts of art, and they destroy life in the space of a few hours.

Where *habit* renders the increase of biliary secretion a common and troublesome occurrence, as is the case especially with many in this country who have passed a part of their lives in either of the Indies, or any hot climate, much may be done by a regular and steady perseverance in a course of medicine: during the violence too of the bilious attacks relief can almost always be given, and sometimes this may be effected by methods different from those

employed in common practice. It once happened to me to stop a violent vomiting of green bilious matter, connected with an early state of pregnancy, and which had continued under aerated draughts with opium and various other medicines, by the administration of kali præparatum alone, without the addition of any acid, and there is reason to believe that this practice may be often useful in green vomitings from other causes, though experience has not hitherto sanctioned its application. One point of a general plan upon which, in these habitual returns of bilious affections, I have placed great reliance, is the regular use of some mildly cathartic mineral water, and if it contained some iron so much the better; such waters are common in this country, and especially about London, so that there is no difficulty in obtaining them. Those of Cheltenham I have seen of great service, and I think that from Godstone, in Surry, likely to answer this purpose as well, or perhaps

better than any, indeed because at the same time that it is effectual, it is remarkably pleasant to the taste, and its use is therefore persevered in without inconvenience. I have taken some trouble in making an accurate analysis of this water, which hereafter I may probably publish. To this it will sometimes be necessary to add small quantities of some bitter tincture, especially that of colombo, and a strict attention to regularity of diet, which should in a great measure consist of easily digestible animal matter, must be enforced. In our endeavors, however, to establish any plan which is to be continued for a length of time, we must yield somewhat to the comfort of the individual, and the established practices of society, for without this no course of medicine will be followed farther than for the removal of immediate suffering.

The *aqueous state* of the bile is rather a symptom than a disease, as it is connected with that general debility which

affects the state of all the fluids of the body. The employment of those means which are sufficient to remove the original disease will also restore its natural characters to this secretion also. •

FINIS.

PLATE I.

Fig. 1. Interior view of a crystallized concretion of the natural size, to show, the crystallized radii shooting from a central nucleus to a definite boundary, and the strata afterwards deposited around this, the deviation from the form of the original concretion which these depositions afterwards assume, and the color of the matter of the concretion, which I consider as drawn from the medium in which it shoots.

Fig. 2. A piece of the same concretion magnified to show more distinctly its crystalline structure, and the fracture through the centre which all the crystallized concretions tend to on the application of mechanical force.

Fig. 3. One of a large number contained in a gall bladder, formed by two distinct thin strata, around a large amorphous mass, which seems composed of smaller concretions or incrustations of lumps of bile united together, the exterior stratum is peeled from the interior for a considerable distance, and the spicular tendency of each of these incrustations is to be noticed.

Fig. 4. Another of the same concretions, divided more equally, and showing its central structure, contrasted with that of the crystallized. The two likewise shew the difference of external shape in concretions from the same bladder, and that the force applied has broken them irregularly, and in a very different way from the crystallized species.

Fig. 5. An external view of an irregularly shaped concretion of the deposited variety, without any crystallized structure.

Fig. 6. One of the same concretions divided to show its internal structure, and the probability that two distinct nuclei had been engaged in its formation.

Fig. 7. The last magnified to show a beautiful appearance of very small crystalline dots which are often scattered through the porous brown nucleus of such concretions, and which I believe to be formed of the usual crystallizable matter of concretions.

PLATE II.

Fig. 1. A pure and unmixed crystallized concretion, in which the crystalline plates radiate from the centre to the circumference.

Fig. 2. A similar concretion, the nucleus of which is colored, and apparently formed of a particle of bile, and the size is increased by subsequent stratified depositions of a similar matter, but tending more to a spicular than a plated structure.

Fig. 3. A concretion, with an irregularly studied surface, resembling the structure of the mulberry, but which does not descend deeper than the surface.

Fig. 4. One of three large concretions, of about the same bulk, which were passed without material injury to the health of a woman, and which bore marks of close application to each other: this end shows the irregularly mottled soapy appearance, which is sometimes found.

Fig. 5. A piece of the above concretion broken from its other end to show the internal structure.

Fig. 6 and 7. Two irregularly angular concretions from one bladder.

Fig. 8. A section of 7, showing its internal structure, its central point, the circular boundary of the first shoot of crystals, and its gradual assumption of an angular form by subsequent depositions.

Fig. 8. A black concretion, so friable as to have lost its cohesion, and fallen into the detached pieces in which it is represented, from the slightest touch.

Fig. 9. A lamellated black concretion without any appearance whatever of crystallization.

For the drawings from which the plates were engraved I am obliged to Mr. F. BAÜER.

